Broadband in Oregon

A Report of the
Oregon Broadband Advisory Council

Presented to the

Joint Legislative Committee on Information Management and Technology

for

The Eightieth Legislative Assembly

November 1, 2018

2018 Broadband in Oregon

Contents

Executive Summary

This is the fifth report of the Oregon Broadband Advisory Council (OBAC) to the Legislative Assembly on the affordability and accessibility of broadband technology in all areas of the state, and on broadband technology use in healthcare, energy management, education and government. The 2018 report will also present information on the role of broadband in local, regional and state economies, economic development, public policy issues, and key broadband related challenges and opportunities and facing the state.

The internet, and broadband access to it, continue to grow in importance as it becomes the platform on which the world works. This year, global broadband subscriptions surpassed the one billion mark. In 1997, global internet traffic was less than 1 Gigabyte (GB) per second (0.03 GB), in 2016 global internet traffic was 26,600 GB per second, and by 2021 it is projected to be 105,800 GB per second.

> "Broadband is not a speed. It is the capacity to meet the social, cultural and economic demands of internet users, which grow and evolve over time."
> — Jonathan Chambers

OBAC believes that Oregon's broadband public policy needs to be focused on the future, be more aggressive, be more financially supportive, be more specific, and have a renewed sense of urgency.

OBAC has observed and frequently reported that "broadband" is a moving target and that broadband infrastructure will always be a work in progress. This is critical for the assessment of *Broadband in Oregon*. The Federal Communication Commission's (FCC) current benchmark for broadband is 25 Mbps downstream and 3 Mbps upstream, and that bar will be raised in the future due to improving technologies, the introduction of new applications and ever increasing end-user demand. This means that the digital divide not only continues to exist, but will grow without new and continued investment in broadband infrastructure. This means that Oregon communities that do not have access to today's or tomorrow's national standards for broadband services will not be able to adequately support long term economic growth.

Key Broadband Challenges and Opportunities

OBAC has identified the following key broadband challenges and opportunities facing Oregon.

- Digital Inclusion: Oregon needs state-level strategies and programs to ensure that all individuals and communities have access to affordable state of the art broadband communications services, and the skills, knowledge and technical support needed to use them.
- Cyber Security: The security of data and communications systems continues to be a critical risk exposure for government, public organizations, private sector businesses, and for individuals that is widely unrecognized and under managed. Oregon needs to follow-through on its 2017 cyber security initiatives www.cyberoregon.com. Ongoing, expanded and pro-active cyber risk management is needed.
- Education: Oregon's K-20 educational institutions are positioned to realize significant economic, work force and community development benefits for the state through the

utilization of broadband networks and applications. State level support and coordination is needed.

- Public Safety: Oregon's first responders are at a transition point for migration to new broadband Internet Protocol (IP) technologies. Support is needed for Oregon's 911 centers and first responders to migrate from legacy systems to Next Generation 911 and to interoperable wireless broadband communications systems.
- Agriculture, which contributes more than $8.25 billion to Oregon's economy each year, is emerging as an important application and will become the largest driver for broadband infrastructure deployment in rural areas of the state.
- Local Community Broadband Planning: Local community engagement in broadband development, adoption and utilization continues to be a high-return "game-changing" activity to be promoted and supported.
- Federal Funding Programs: Federal broadband programs are currently in flux but remain a key source of available financing to be leveraged for new infrastructure.
- Network Interconnection: Oregon needs to develop near-term strategies to improve the state's connectivity to national and global networks and support the growth of network enabled datacenters and e-commerce businesses.

To address these challenges, OBAC offers the following recommendations
- Create a dedicated state government broadband office.
- Provide state funding for new grant, loan and loan guarantee programs for broadband infrastructure in unserved and underserved areas, and for matching funds to leverage federal funding programs.
- Repurpose and redesign the Oregon Universal Service Fund to be sustainable and to improve and subsidize broadband infrastructure in unserved and underserved areas.
- Provide support to low adoption populations and community anchor institutions, e.g., the FCC's E-rate Program, Healthcare Connect Fund and Lifeline programs.
- Promote broadband infrastructure deployment.
- Require that broadband infrastructure components such as conduit be included for all state funded infrastructure programs including roads, bridges, water, and wastewater projects.
- Remain technology and provider neutral.

Broadband is essential infrastructure for Oregon, its businesses, government, schools, libraries, utilities, healthcare providers, first responders and families.

Infrastructure Trends and Technologies

Industry Structure

Oregon is served by a mix of franchised telephone companies, cable companies, competitive access providers, fixed and mobile wireless companies, satellite service providers and publicly owned municipal and consortia telecommunications networks. These providers are represented by associations including the Telecommunications Association of Oregon www.ota-telecom.org, the Oregon Cable Telecommunications Association www.oregoncable.com, and the Northwest Telecommunications Association http://nwta.biz/.

Wireline

Fiber, copper and cable networks supported 77% of fixed subscribers worldwide at the end of last year, according to global fixed broadband statistics compiled by Point Topic, which found that more than half of people get their broadband over fixed wireline networks in more than 40 countries. 87% of the broadband subscribers in the United States get their broadband over fixed wireline networks. The fiber and fiber/copper systems include Fiber-to-the-Home (FTTH), Fiber-to-the-Building (FTTB), Fiber-to-the-Cabinet (FTTC), Very High Bitrate Digital Subscriber Line (VDSL), VDSL2, legacy twisted pair copper, coaxial cable and G-fast (a technology that enhances the performance of legacy twisted pair copper). A second generation of G-fast is being promoted as enabling operators to deliver Gigabit speeds to their customers over twisted-pair copper facilities. AT&T, Frontier, and CenturyLink are using the technology to serve customers in multiple dwelling units like apartment buildings. http://www.telecompetitor.com/broadband-forum-citing-global-fixed-broadband-statistics-fiber-now-underlies-77-of-all-connections/

Voice Telephone Service

The traditional franchised telephone companies continue to be key service providers though their market share continues to decline. The FCC's Wireline Competition Bureau issued its Voice Telephone Services Report on February 7, 2018, which summarizes the information collected on telephone services as of December 31, 2016. The report noted that in December 2016, there were 58 million end user switched access lines in service, 63 million interconnected VoIP subscriptions and 341 million mobile subscriptions in the United States. Over the previous three-year period, interconnected VoIP subscriptions increased at a compound annual growth rate of ten percent, mobile voice subscriptions increased at a compound annual growth rate of three percent and retail switched access lines *declined* at twelve percent per year. [Voice Telephone Services: Status as of December 31, 2016, Industry Analysis and Technology Division Wireline Competition Bureau February 2018.]
https://prodnet.www.neca.org/publicationsdocs/wwpdf/020718voicereport.pdf

Digital Subscriber Line Service (DSL)

Copper twisted pair telephone wiring continues to deliver broadband services and potentially could support dramatically faster speeds with new technologies. ASSIA, broadband software development company, is working to improve speeds by using a waveguide approach in combination with vectoring. Key to supporting dramatically high speeds over copper would be to use higher frequencies for data transmission. ASSIA believes that DSL technology–based on waveguides, ultra-high frequency transmission and vectoring over twisted pair–could support

terabit speeds over distances of 100 meters, speeds of 100 Gbps over 300 meters and 10 Gbps over 500 meters. The technology might support lower but serviceable speeds over distances of up to 700-1,000 meters with low latency breathing extended life into this legacy infrastructure. http://www.telecompetitor.com/assia-chief-dsl-could-support-terabit-speeds/

Nevertheless, AT&T reports that it now has more than five times fewer legacy DSL customers than it did four years ago. AT&T is transitioning from DSL to Internet Protocol (IP) broadband, the term the company uses for services delivered over fiber-to-the-premises (FTTP) and fiber-to-the-node (FTTN) infrastructure. The company also uses the term "high-speed broadband" to describe those services. Today, about 800,000 AT&T residential customers are still on "legacy DSL," as compared to about 4.5 million legacy DSL customers just four years ago. AT&T fiber now passes more than 8 million customer locations. In areas where AT&T has marketed fiber for the last two years, it has obtained a nearly 50% penetration rate. AT&T aims to reach 12.5 million locations with FTTP by 2019. AT&T has set a long-term goal of making high-speed broadband available to 50 million locations, likely through a mix of FTTN, FTTP and fixed wireless.

The telecom financial analyst firm Moffett Nathanson forecasts cable companies to eventually gain broadband market share in the range of 80% where the cablecos compete against telephone company legacy DSL. When competing against IP DSLAM-based broadband or FTTN, Moffett expects cablecos to see market shares of 60% and 55%, respectively. But when competing against FTTP, the researchers forecast cablecos to have market share of 40%. http://www.telecompetitor.com/cfo-att-high-speed-broadband-will-reach-50-million-locations-without-capex-increase/

Public Switched Telephone Network (PSTN)
CenturyLink has petitioned the Federal Communications Commission for permission to retire its legacy copper-based infrastructure in select Minnesota and Nebraska communities, with the intention of replacing the copper with fiber loops. CenturyLink also wants to switch certain facilities in Minnesota to fiber-fed digital loop carrier systems.

Verizon also recently asked the FCC for permission to retire copper in areas of New England, New York and Pennsylvania as it continues moving customers to fiber-based technology. After the retirement, Verizon says it will no longer offer services via copper facilities and cease maintaining them. https://www.channelpartnersonline.com/2018/09/04/centurylink-targets-2-midwestern-states-for-copper-retirement/

The FCC is currently proposing to increase the Universal Service contribution factor to exceed 20%. It will be 20.1% for the fourth quarter of 2018, according to a new FCC public notice. An FCC spokesperson confirmed that it is the highest ever. This means that just over one-fifth of every dollar that users spend on interstate and international telecom services (essentially long-distance voice services) will go toward the Universal Service Fund (USF) program. This may well be another nail in the coffin of the legacy PSTN and Time Division Multiplexed (TDM)

voice services by making it even more expensive to use and less competitive with Voice over Internet Protocol (VoIP) services and wireless voice services.
https://www.telecompetitor.com/universal-service-contribution-factor-surpasses-20-for-the-first-time-highest-rate-ever/
https://docs.fcc.gov/public/attachments/DA-18-944A1.pdf

Voice calling, in general, is under attack. Robocalls, or unsolicited prerecorded telemarketing calls to landlines and wireless phones, are an aggravating problem that is getting worse each year. First Orion Corporation, a company that provides spam call filters to telecommunications carriers, reported that in 2018, 29.2% of all calls are robocalls, which is a 3.7% increase from 2017. First Orion projects that in 2019, 45% of all calls will be spam and robocalls. Increasingly, people are no longer answering their voice calls unless they recognize the caller. Verizon and AT&T are planning to introduce a $100 million project next year to attempt to curb unsolicited telemarketing robocalls on landlines and cellphones.
https://www.komando.com/happening-now/489341/research-50-of-all-calls-are-robocalls-how-to-stop-them-on-your-phone

Federal support for wireline infrastructure
The Connect America Fund (CAF), also known as the Universal Service High-Cost program, is an FCC program to expand access to voice and broadband services in areas where they are unavailable. CAF is a six-year plan comparable to earlier federal programs to extend electricity and basic telephone service to rural America early in the twentieth century, and to build the interstate highway system in the 1950s and '60s.

Through CAF Phase II, the FCC is providing funding to local telephone companies to subsidize the cost of building new network infrastructure or performing network upgrades to provide voice and broadband service in areas that are unserved or underserved.

USAC just released an interactive online map displaying the impact the Connect America Fund (CAF) program has had on in rural America. The CAF map shows where carriers that receive CAF support have deployed high-speed internet service. The map may be accessed at:
https://data.usac.org/publicreports/caf-map/ .

The CAF program reflects the FCC's repurposing of the Universal Service Fund from basic voice telephone service to broadband.

CenturyLink
CenturyLink accepted Connect America Fund Phase II (CAF II or CAF2) support across its service territory including Oregon, and plans to deploy 10x1 Mbps service to more than 41,000 rural high cost living units in dozens of wire centers throughout Oregon and that thousands of additional living units adjacent to CAF 2 areas will benefit from the fiber optic cable being placed as part of the buildout program. All broadband deployment under the CAF2 funding will be completed in 2020.

CAF2 is aimed at improving service to rural high cost to serve areas. Low population density and terrain are major deployment challenges.
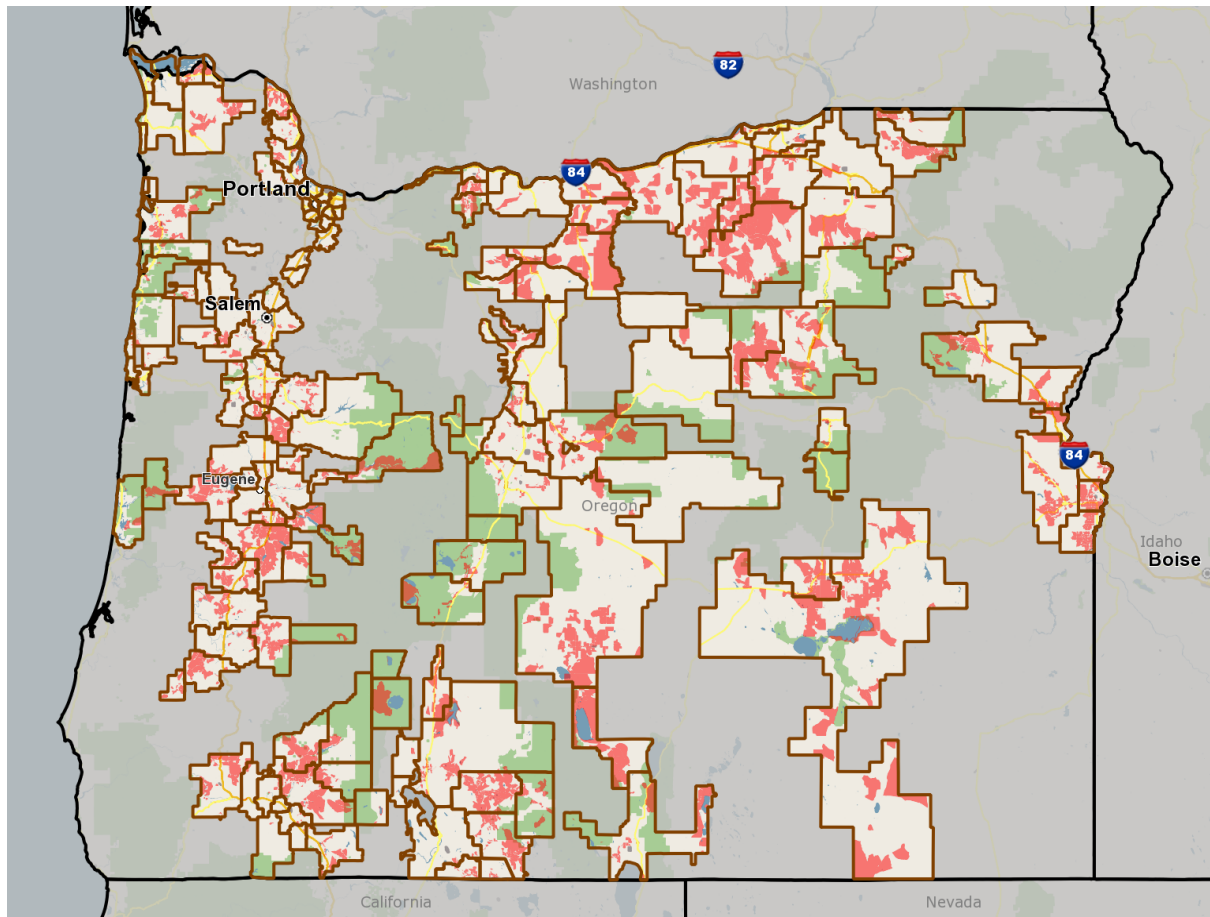
Oregon CAF2 Targeted Areas

This map displays CAF2 targeted areas within the CenturyTel service territories in Oregon.

Rural Broadband deployment key learnings …
- Low density, high cost rural areas by their very nature are expensive to upgrade and serve
- The primary cost of deployment is fiber optic placement – trenching / aerial
- CAF 2 has spurred a number of manufacturing advances in broadband equipment tailored for rural markets
- Alternative technologies for last mile connectivity are evolving and may be used in certain instances
- Terrain is still a major deployment challenge
- Deploying fiber optic cable deeper into rural America will provide the foundation for future broadband upgrades

Customer densities will decline with future rounds of CAF making network buildouts more challenging. CenturyLink is exploring both wireline (including copper and fiber facilities) and wireless technologies (including 5G) to address broadband improvement needs.

Broadband deployment projects are currently underway and CenturyLink is on target to meet all the federal milestones under CAF2.

CAF 2 Milestones by Year
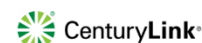
CenturyLink CAF2 Milestones

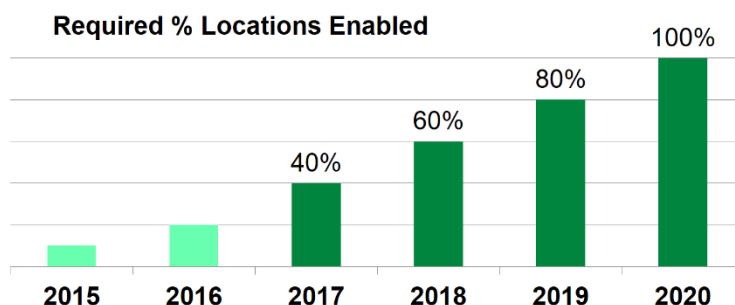At a recent trade show, CenturyLink described its ongoing transformation to an enterprise-first carrier building on its 2017 acquisition of Level 3 Communications. The enterprise business is the "Tip of the spear," with other business opportunities flowing from it. CenturyLink seeks to become the leading provider of enterprise class services in every market it serves across 60 countries. CenturyLink network reaches 26 million consumer locations, just over 10 million of which are now capable of receiving 40 Mbps service or better. Over 4 million can receive 100 Mbps or better, and over 1.8 million are gigabit capable. CenturyLink has been offering gigabit speeds in a growing share of the Portland market since 2014.
http://www.telecompetitor.com/centurylink-enterprise-is-tip-of-the-spear-but-consumer-biz-alone-is-still-a-fortune-500-company/

Frontier Communications

Frontier also accepted Connect America Fund Phase II (CAF II) support across its service territory totaling $330 million annually for 6 years with 774,000 households and businesses in eligible census blocks across twenty-nine states. In Oregon, Frontier accepted $3.9 million in annual funding to deploy 10/1 Mbps service with 8,542 households in eligible census blocks to be served. Frontier achieved 49% enabled CAF II households/service locations in Oregon, and exceeded the required 40% completion in all twenty-nine states at the end of 2017. Targets are for 60% completion in 2018, 80% completion in 2019, and 100% completion by the end of 2020.

CAF Phase II is the FCC's support for broadband deployment to identified high-cost households in areas without "unsubsidized" competitors. It is a six-year program (2015-2020) with total funding of about $1.8 billion annually over six years starting in 2015 and completing by December 31, 2020.
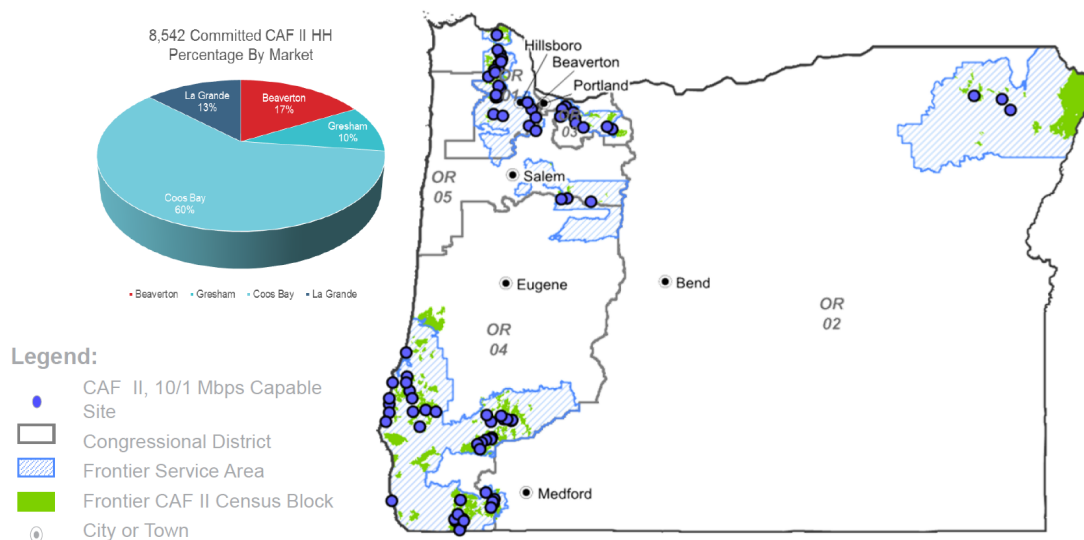
Frontier CAF II Oregon Deployment

CAF II-served locations must have broadband service available with at least 10 Mbps/1 Mbps, have voice service, have comparable pricing to urban markets, have latency below 100 milliseconds, and any usage allowance no less than 100 Gigabytes (GB). Frontier does not have usage caps.

Frontier seeks to provide service speeds greater than 10x1 Mbps where it has the capability. The areas in blue on the map above indicate completed CAF II projects as of the end of the first Quarter of 2018.

Frontier's Oregon market territories consist of Beaverton, Tigard, Gresham, Coos Bay, and La Grande which include 68 Wire Centers and over 400,000 households. Since 2015 Frontier has completed transport upgrades throughout Oregon and its core network with 10 Gigabit and 100 Gigabit connections, increased redundancy, increased peering with other carriers, and migrating to IP in support of current and projected Oregon network growth.

Nationally related to broadband deployment in rural areas. Frontier has tested and is deploying fixed wireless point to point and point to multi-point configurations in CAF markets. Fixed

wireless is not currently deployed in Oregon but will be in the future. Frontier also utilizes fiber-to-the-premises, fiber-to-the-node, very high speed DSL (VDSL), pair bonding, G.FAST, and other technologies in delivering broadband services.

The FCC has released an additional $36 million annually for 175 small rural carriers that opted to transition to receive broadband Universal Service support based on the alternative Connect America cost model. In exchange, these carriers have committed to more aggressive broadband deployment goals including the following Oregon recipients.

Recipient	Annual Support
Day Management Corporation	$3,884,943
Helix Telephone Company	$359,170
Monroe Telephone Company	$622,016
Pioneer Telephone Cooperative (OR)	$4,254,978
Roome Telecommunications Inc.	$485,925
Telephone and Data Systems, Inc.	$229,227

https://www.telecompetitor.com/fcc-authorizes-an-additional-36-million-annually-to-a-cam-carriers-for-rural-broadband-support/

Frontier Communications recently announced that it is introducing a new Gigabit service in its FiOS and Vantage Fiber markets. It will increase its consumer broadband service offerings to include symmetrical 200/200 megabits per second (Mbps), (symmetrical 300/300 Mbps) previously not offered in Oregon. https://www.oaoa.com/news/business/article_a0325364-bf91-5fdf-8146-0deb178e374a.html

Cable Companies
Cable companies continue to dominate broadband service market share nationally and in Oregon. The broadband industry had 2,095,203 broadband net additions last year, according to the Leichtman Research Group (LRG). The increase was driven by the top cable companies, which added a net of 2,720,827 broadband subscribers. That offset net losses of 625,624 from the top telephone companies.
- The top cable companies added 2.7 million broadband subscribers in 2017–83% of the net additions for the top cable companies in 2016
- Comcast has added over a million broadband subscribers each year from 2010-2017
- Charter has added over a million broadband subscribers each year from 2014-2017
- The top telephone companies lost about 625,000 subscribers in 2016–similar to a loss of about 600,000 subscribers in 2016

http://www.telecompetitor.com/lrg-cable-continues-to-dominate-broadband-net-adds-among-the-largest-providers/

The cable industry has completed its Full Duplex Data-Over-Cable-System-Interface-Specification (DOCSIS) specification. The specification establishes how data can flow symmetrically in both the upstream and downstream directions over hybrid fiber-coaxial networks, enabling full duplex broadband. Cable traditionally has less than 20% of its spectrum

allocated to upstream. This innovation removes that limit, though requires significant investment in order to achieve symmetric service. Anticipating a change in user demand as emerging technologies require more bandwidth, CableLabs' Full Duplex DOCSIS technology will ensure that cable operators can be ready to meet future usage needs for technologies such as virtual and augmented reality. DOCSIS 3.0 and subsequent releases have been key to cable companies offering competitive high broadband speeds.
http://www.businesswire.com/news/home/20171011005213/en/CableLabs-Significantly-Increases-Internet-Speeds-HFC-Network

BendBroadband

A new BendBroadband 600 Mbps broadband service was recently announced by parent company Telephone and Data Systems, Inc. (TDS). Like the previous TDS cable network upgrades, this BendBroadband 600 Mbps tier is powered by DOCSIS 3.0 technology. BendBroadband Ultra 600 provides customers up to 600 Megabits per second (Mbps) download and up to 20 Mbps upload speed. Although TDS is using DOCSIS 3.0 for the 600Mbps tier, DOCSIS 3.1 has been deployed throughout the cable footprint.
https://tdstelecom.com/about/news/categories/bendbroadband/600LaunchBend.html

Since the last OBAC report, TDS has also completed the acquisition of Crestview Cable Communications (Crestview) in central Oregon. The sale includes service areas totaling more than 21,000 homes passed in six communities. TDS plans to further expand fiber-to-the-home in the La Pine area. TDS also plans to accelerate broadband speed upgrades along with modernizing video products and services in Prineville, Madras, and across the Jefferson and Crook counties service areas.
http://www.prweb.com/releases/2017/11/prweb14867314.htm

Comcast

Comcast began offering gigabit connections throughout its Oregon service territory in June of 2017 and has announced that it is increasing the speeds of its Xfinity internet service packages for millions of video and internet customers, including in Oregon and SW Washington. Speed increases will vary based on the Xfinity internet customers' current speed subscriptions. Those receiving the speed boost will benefit from an increase of 30 to 40 percent in their download speeds. Existing Xfinity internet and X1 video customers subscribing to certain packages can expect to experience enhanced speeds this month.

Internet Tier/Customer Package	Current Download Speed (Mbps)	New Download Speed (Mbps)
Performance Plus/Saver, Double, Triple or Quadruple Play	60	150
Performance Pro/Starter, Triple Play	150	250
Blast! Pro/Preferred and Premier, Triple Play	250	400
Blast! Pro/Preferred and Premier, Quadruple Play	250	1,000

To get the increased speeds, most customers just need to re-start their modems when notified by Comcast that the new speed is available in their area.

The Comcast Business DOCSIS 3.1 footprint has been expanded to business customers in the Western United States, including Oregon**,** and Washington. With the expansion, Comcast's "Business Internet 1 Gig" and "Business Internet 500" speed tiers are now available to business customers using the company's existing network. The company's DOCSIS 3.1-based business internet service is designed to provide gigabit speeds for any business environment–whether a distributed enterprise with offices across the country, or a small business with only a handful of locations. With the continued roll out of its gig-speed network, Comcast's "Business Internet 1 Gig" and "Business Internet 500" speed tiers are now available to business customers.
http://www.telecompetitor.com/comcast-business-docsis-3-1-footprint-expands-westward/

Comcast is service bundling and its Xfinity mobile's pricing strategy is acquiring customers from all major carriers, according to a new study from Market Strategies International, which also declares the Comcast quad play "firmly rooted," thanks to Xfinity mobile. The new report finds that almost 60% of current Xfinity mobile customers said they switched because of the better deal, while an additional 27% cited the better deal and dissatisfaction with their previous provider as the reasons for switching. Comcast Xfinity's "quad play" bundles broadband internet access, cable TV, telephone and mobile wireless services.
http://www.telecompetitor.com/report-declares-comcast-quad-play-firmly-rooted-with-verizon-being-the-biggest-loser/

Charter Spectrum
Charter Spectrum is a national, growing TV, internet and voice provider with 94,000 employees that connects more than 26 million residential and business customers in 41 states. Charter Spectrum serves over 214,000 customers in ninety-six Oregon communities providing 100 plus Mbps speeds. In 2017, the company deployed sixty-five miles of new network adding over 1,950 customer locations passed.

Charter has just launched Spectrum Internet Gig improving its speeds for customers.
- This service delivers a 1 Gbps connection to customers' homes.
    - With Spectrum Internet Gig:
        - customers have access to faster and more powerful internet speeds to stream video, play online games, across multiple devices without sacrificing performance;
        - Small- and medium-sized businesses have the bandwidth they need to power their work and grow their businesses as well as their local economies.
- Rolling it out here is another important step toward reaching out goal of making gigabit connections available across virtually its entire 41 state footprint by the end of 2018.

Charter is investing in its infrastructure and technology to provide customers with innovative offerings and a better overall experience.

- Since 2014, Charter has invested more than $27 billion in technology and infrastructure to extend the reach of its network including to underserved and unserved homes in businesses in rural areas, and to increase its broadband speeds at no additional cost to customers.
- Last year, the company expanded its network to reach an additional 860,000 homes footprint-wide.
- Charter is fully committed to bringing faster internet speeds to all communities it serves whether they are urban, suburban or in more rural areas.
  - In 2017, Charter boosted its starting broadband speed from 60 Mbps to 100 Mbps at no extra cost to customers.
  - This starting broadband speed is 20 times faster than it was 8 years ago while the price per Mbps for customers has decreased by 93%.

Charter is investing in a future that will deliver the next generation of broadband connectivity across the 41 states it serves.
- Charter is currently exploring how to integrate 4G LTE, 5G and other advanced wireless technologies which combined with its network will enable it to enhance connectivity for customers.
- Charter is conducting trials of both mobile (small cell) and fixed wireless access technologies in markets across the country.

These trials along with Spectrum Internet Gig and its new mobile service demonstrate ongoing investment in network infrastructure to meet the current and future needs of its customers.

Wave

Wave Broadband will begin offering gigabit internet service in 18 small Oregon communities, including several where it is the first such provider. A gigabit is 1,000 megabits per second, 40 times faster than the federal broadband standard. Wave reports that its gigabit service is now available at residential and business addresses in Oregon City, Aurora, Barlow, Canby, Donald, Scotts Mills, Molalla, Aumsville, Gates, Lyons, Sublimity, Turner, Gervais, Hubbard, Woodburn, Silverton, Mt. Angel, and Sandy. https://www.oregonlive.com/silicon-forest/index.ssf/2017/11/gigabit_internet_service_comin.html

Despite market domination as broadband service providers, cable companies are facing changing patterns of use in the consumption of television and video entertainment which are important products and revenue streams for cable companies. Television consumption is evolving from live scheduled programming to on-demand video. The research firm Parks Associates issued the results of a study, "Shifting Video Consumption: Linear vs. On-Demand," reporting that almost 60% of television viewed in broadband households in the United States is on-demand and non-linear. A bit more than one-quarter of television viewed by 18 to 34-year-olds is of live sources, which include pay TV, over-the-air channels and livestreaming. S&P Global Market Intelligence is forecasting that more than 37 million households will be relying exclusively on broadband for video by 2022. These changes are related to the growth of streaming and use of non-television devices to access content.
https://cdgportal.com/blog/index.php/2018/03/19/on-demand-tv-viewership-spiking-now-accounts-for-60-of-viewing-in-some-households/

Seventeen percent of US households now get their content solely from subscription-video-on-demand services, up from 11% last year, per a study from The NPD Group. The study found that 40% of consumers subscribe to just one service, while nearly one-quarter subscribe to three or more MediaPost Communications (an on-line publishing resource for advertising media professionals). Netflix added 7 million subscribers in the third quarter of 2018, surpassing expectations and bringing its total customer base to 137 million. Walmart is now developing a streaming video service to rival Netflix and Amazon for as low as $8.00 per month
https://ca.reuters.com/article/businessNews/idCAKCN1MQ2R5-OCABS

Mobile Wireless

Mobile wireless telephone services were commercially introduced in the early 1980s, and approximately every ten years there has been a significant improvement in wireless technology, marked by established industry standards, which have expanded services and enhanced network performance and capabilities.

The First generation of wireless telephone technology (1G), commercially introduced as Advanced Mobile Phone Service (AMPS) and more commonly known as "cellular service" provided mobile wireless voice service over analog transmission networks. The second generation of wireless telephone technology (2G) was introduced in the 1990s. The industry migrated to Digital transmission networks with expanded user capacity for voice customers and with the addition of text messaging capability. 2G introduced new communications protocols (CDMA, GSM, TDMA) with transmission speeds under one million bits per second, less than 1 Mbps. The third generation of technology (3G) enabled faster data transmission rates in the late 1990s with enhancements (3.5/3.75 G) in the early 2000's that enabled mobile internet access delivering several megabits per second (Mbps) to the newly introduced smart phones and other mobile wireless devices. Fourth generation (4G) technology was introduced in the late 2000's. It increased network speeds again, and then was further enhanced by 4.5G, commonly known as 4G Long Term Evolution (LTE). 4G mobile standards are capable of supporting transmission speeds in the 100s of Mbps, and the technology will continue to be developed. Actual LTE connections in the first quarter of 2018 exceeded 100% of the market for the U.S. and Canada with a total of 365 million connections (the population was 364 million).

The fifth-generation technology (5G) is still under development. It will be the next phase of mobile telecommunications standards providing still **greater** capacity, **faster** speeds, **better** coverage, **lower** latency, **better** power efficiency, and more frequency spectrum efficiency than current wireless technologies.

Mobile wireless has been a notable growing segment of the telecommunications industry enjoying rapid expansion. The Cellular Telecommunications Industry Association (CTIA), a trade organization that represents the U.S. wireless communications industry, released their latest research on U.S. mobile usage trends. There are more than 400 million mobile devices in service in the U.S., or 1.2 devices for every man, woman, and child in the country. Mobile data usage totaled 15.7 trillion megabytes of data, text messages totaled 1.5 trillion, and voice minutes totaled 2.2 trillion in 2017. The U.S. wireless industry employs more than 207,000 workers, and collectively invested $25.6 billion in CAPEX during 2017. There were 273 million active

smartphones in use at the end of 2017, a 5.5-fold increase since 2009. Those smartphones interacted with 323,400 cell sites across the country. Cell sites have grown 52% over the last decade. The move to 5G will require 800,000 new small cells, the association predicts. https://www.telecompetitor.com/ctia-u-s-mobile-usage-includes-1-5-trillion-text-messages-and-15-7-trillion-mbs-of-data/

The use of mobile wireless networks is growing. About 52 percent of American households are now wireless only for voice. The average North American smartphone user will use 48 Gigabytes (GB) of data per month by 2023 up from 7.1 GB in 2017. The average household now has 13 connected devices. Increasingly, network connectivity to the end user's device is wireless. Mobile broadband growth is being driven by smart phones, tablet computers and other mobile wireless devices. The International Telecommunication Union (ITU) reports that worldwide, mobile broadband subscriptions have grown by more than 20 per cent in each of the last five years as compared to the number of fixed-location broadband subscriptions, which has increased by nine per cent annually in the last five years. https://news.un.org/en/story/2017/07/562562-mobile-broadband-subscriptions-track-hit-43-billion-2017-un-report#.WYNxzMeGM2w%20Fi

The number of mobile broadband subscriptions is expected to double by 2022 to 8.3 billion globally. That's up from 4.6 billion in Q1 2017. Mobile broadband subscriptions—which include subscriptions for smartphones as well as tablets and other devices—grew 25 percent year over year, according to a new report by telecommunications equipment company Ericsson https://www.ericsson.com/en/mobility-report. Broadband subscriptions made up 60 percent of all mobile connections this quarter, up from 57 percent at the end of 2016. Total mobile subscriptions reached 7.6 billion, up 4 percent from last year. Currently, 80 percent of the world's population could potentially connect to a mobile broadband network; Ericsson anticipates a 95 percent coverage rate in 2022. https://www.recode.net/2017/6/18/15826036/smartphone-subscriptions-basic-phonesglobally-ericsson

4G LTE
More than one third (38.5%) of all wireless cellular technology worldwide used LTE in the first quarter of 2018, according to new LTE market share data from 5G Americas and Ovum. North America reported a penetration rate of 76 percent. Actual LTE connections exceeded 100% of the market for the U.S. and Canada in March, with a total of 365 million connections compared to the population of 364 million. 4G LTE will continue to be developed and in service for many years. Ultra Mobile Broadband (UMB) refers to a fourth generation (4G) mobile communications technology that attains improved data rates with up to 275 Mbps downstream and 75Mbps upstream speeds. http://www.telecompetitor.com/report-lte-market-share-hits-76-in-u-s-and-canada/

5G
A significant trend in mobile wireless communications that will impact Oregon in the next three years is the deployment of fifth generation (5G) technology. The vision for 5G is dramatically increased network performance, capacity and capability leading to an era of "Everything on Mobile" while also significantly increasing the number of connections that can be delivered. 5G

will required the continued deployment of fiber facilities to carry the exponentially increasing data traffic.

5G will, for the most part, utilize higher wave frequency spectrum bands which do not propagate well or pass well through obstacles. This will require a high level of cell network densification to provide coverage using small cells in locations such as lampposts, buildings, and utility poles. 5G will significantly increase transmission speeds, support real-time communications, and connect everything. 5G will be the technology that will connect the predicted 50 billion Internet of Things (IoT) devices.
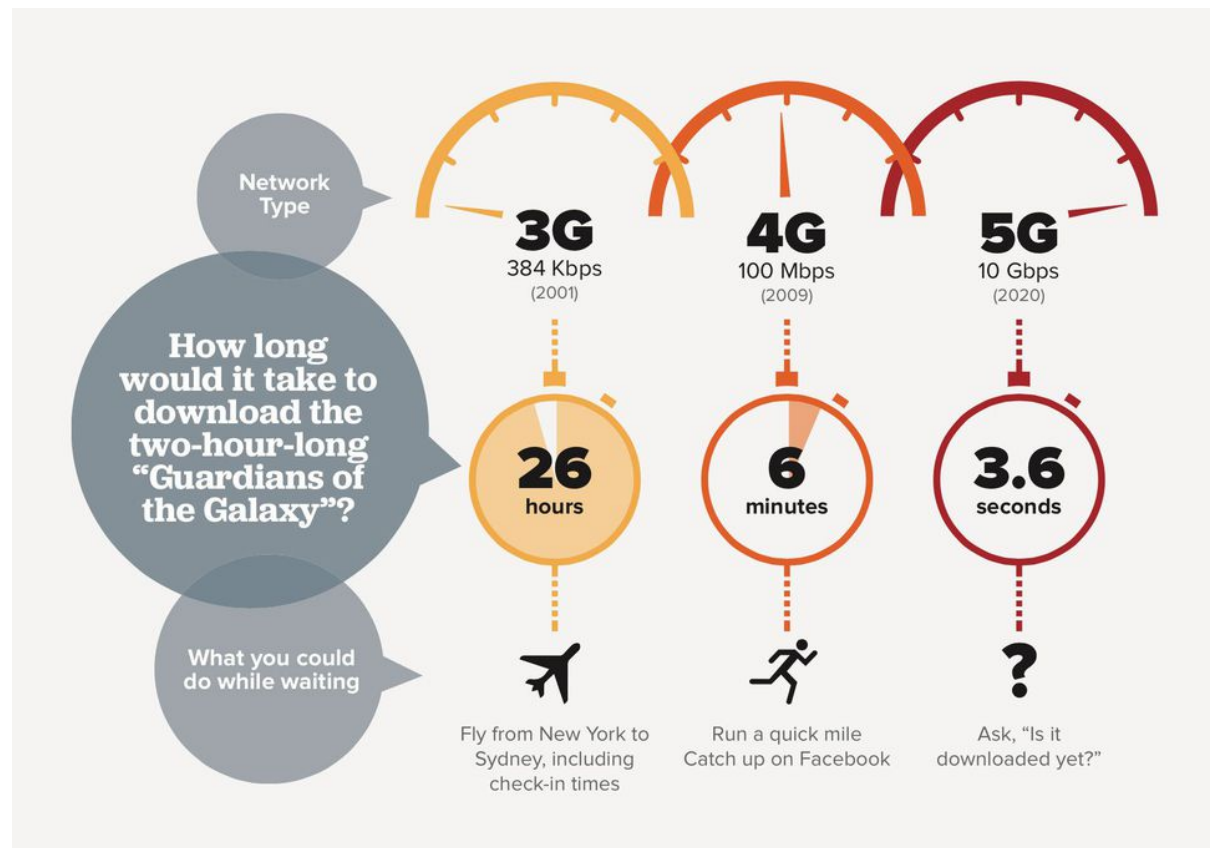
5G Performance
Source: Pacific Technology Alliance

5G will enable data rates of tens of millions of bits per second (Mbps) up to and beyond a thousand Mbps, 1 Gbps, depending on the configuration. 5G is expected to deliver speeds 10-100 times faster than today's average 4G LTE connections, with improved service availability, improved coverage, significant reductions in network and end-user device power use (perhaps up to 90%), and with expected latency in the range of 1-5 milliseconds. Latency refers to the time it takes for a signal to travel from a transmitter to a receiver. Latency on 3G is around 100 milliseconds, and on 4G around 50 milliseconds.

5G will operate on higher frequencies (24GHz), requiring towers or antennas that are close together which will create the need for many more, smaller cells that can change size and shape.

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Some estimates are that 5G will require at least 10 small cells per macro base station in urban settings, where cells are already today relatively tightly meshed to handle data traffic demand.

It is anticipated that 5G will be commercially launched in 2020, though we will see earlier proprietary deployments by key companies such as AT&T, Verizon, Sprint, Qualcomm, Ericsson, Intel, Nokia, LG, and Huawei. An investment of approximately $275 billion is expected in 5G infrastructure in the United States from telecommunications service operators. The scope of 5G network technology deployment is enormous. In 2017, Verizon alone contracted with Corning Glass to provide thirty-four million miles of fiber (enough to reach from Earth to Mars). The volume of fiber reflects on the scale of build and volume of fiber strands anticipated which may strain municipal authorities as they administer permitting and planning activities. New regulations, code and oversight is expected to emerge as a result.

Building Blocks for 5G

- Large contiguous spectrum bandwidth
- Small antennas (**small cell infrastructure**)
- Access to wireline fiber facilities (backhaul)
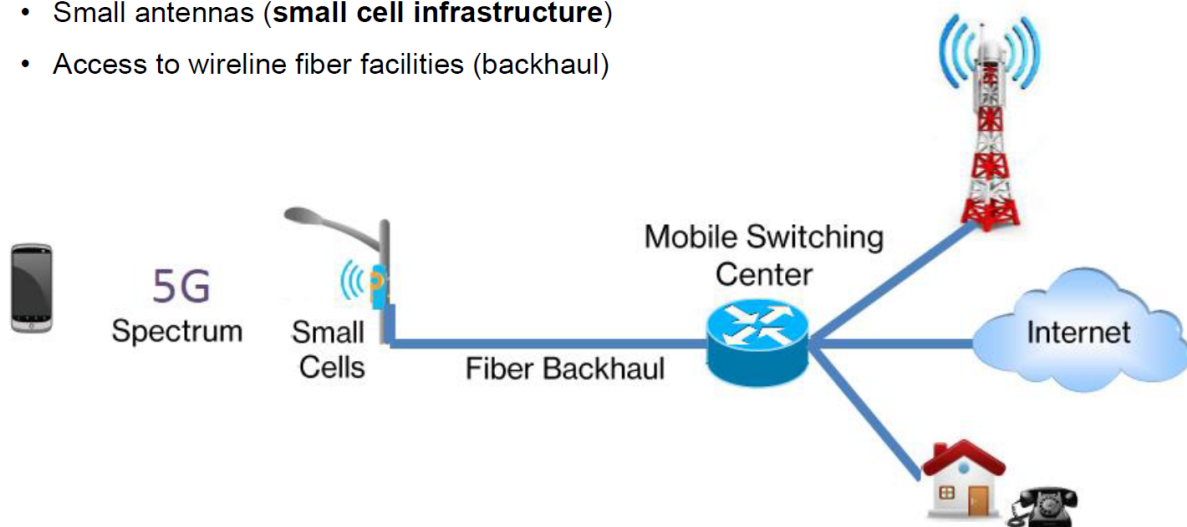
5G Network Components Diagram
Source: Verizon Wireless

Last year, Verizon reported that its 5G mobile wireless system would have a range of about 1,500 feet and would require a large number of cell sites. The latest tests showed the 5G connection maintaining 1Gbps at 3,000 feet from a radio node with a clear, line-of-sight connection, and 800Mbps at a third of a mile from the node through trees. Verizon also showed a 960 Mbps connection through a wall and a window, from a tower a fourth of a mile away. The key is beamforming, which directs connections to the exact spot where a receiver sits. Those speed test results make Verizon's upcoming home service competitive with cable and fiber. Verizon plans to launch 5G home internet service in four cities this year, and more in 2019. Sacramento and Los Angeles will be the first two cities. All four of the major US carriers have 5G plans for 2018 and 2019. AT&T plans to launch a service with a mobile hotspot this year,

and Sprint and T-Mobile have said they will be launching with phones in 2019.
https://www.pcmag.com/news/361360/verizon-shows-5g-going-the-distance

Verizon announced a 5G strategy provide a personalized one-to-one experience to both consumer and business customers including applications like entertainment, gaming, financial transactions, and real time business-to-business communications. Verizon sees certain scenarios when 5G is in full swing in two to three years, where people and businesses will opt to leapfrog fiber type connectivity and go to a 5G based solution instead.
https://www.telecompetitor.com/verizon-5g-will-enable-a-one-to-one-personalized-experience-making-up-for-past-mobile-sins/

Verizon is looking to build a competitive edge in new 5G wireless technology by leading with video entertainment including YouTube TV and Apple TV, delivered over the high-speed, low-latency networks. Verizon is on track to be the first wireless technology provider to deploy 5G residential broadband service in the U.S. later this year, which will provide 20 to 50 times the bandwidth of 4G LTE technology and be a credible replacement for wireline broadband. As mobile devices become available in early 2019, the company expects to be first American carrier to launch 5G mobile service. https://variety.com/2018/digital/news/verizon-5g-youtube-tv-apple-tv-broadband-1202905251/

Verizon is launching *Verizon 5G Home*, the world's first commercial 5G broadband internet service, on October 1 in parts of Houston, Indianapolis, Los Angeles and Sacramento. U.S. consumers can visit www.FirstOn5G.com to learn more about the service and sign up to be a "First On 5G" Member. Verizon expects to be the first company to bring 5G broadband internet service to consumers and to be the first to offer 5G mobile service.
https://www.verizon.com/about/news/5g-here

5G will also be deployed in fixed wireless configurations to compete with wireline broadband access services. In a T-Mobile FCC filing, the company said that following a T-Mobile Sprint merger the new T-Mobile will introduce fixed 5G and expects to win 1.9 million customers by 2021, and 9.5 million by 2024, which would make it the country's fourth-largest home Internet Service Provider. By 2024, the company expects to be offering home internet service in 52 percent of U.S. zip codes. https://venturebeat.com/2018/09/21/t-mobile-details-5g-home-broadband-plan-to-undercut-charter-and-comcast/

Sprint 5G
Sprint plans to use its 5G network deployment to enhance its Internet of Things opportunities by adding a national LTE-M network this year. Also, Sprint's proposed merger with T-Mobile is predicted to boost the overall 5G services market by 17% within five years, research firm Strategy Analytics predicts.
https://www.sdxcentral.com/articles/news/sprint-uses-5g-network-preparations-to-overhaul-its-iot-business/2018/05/?c_action=home_slider

Network infrastructure is a high priority for Sprint and the company's Densification and Optimization Plan will drive additional investment. Sprint is upgrading its network with "tri-

band" technology to deliver service over three frequency bands; 800 MHz, 1.9 GHz, and 2.5 GHz. Existing and thousands of new cell sites (macro and small cell) will be deployed with tri-band to expand coverage nationwide and an up to ten-fold increase in capacity that users will increasingly rely on in the future. Tri band has been deployed in Portland, Salem, Eugene, Bend, and Medford.

Sprint is one of a few operators globally that can deliver both LTE and 5G simultaneously on the same band (2.5 GHz) using 100-200 MHz of licensed spectrum and Multiple Input and Multiple Output (MIMO) technology. MIMO leverages a large number of antennas and "beamforming" to improve capacity and performance. This will enable Sprint to deliver a relatively smooth transition to 5G for its customers. Coverage and resiliency will be improved, network capacity will be increased and latency will be reduced. Sprint is also enhancing end user devices for better performance. Sprint has a competitive advantage given the large amount of licensed spectrum that it holds in its three frequency bands.

Sprint has also developed small cell technologies to accelerate the deployment of small cells.
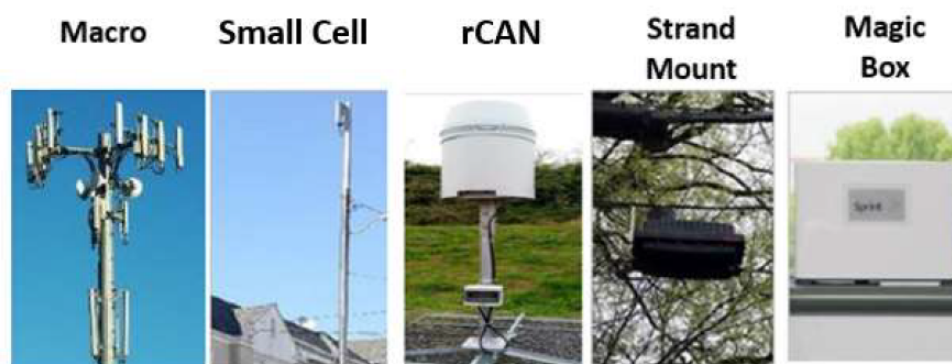
Cell site technologies

Air Strand technology allows Sprint to mount transceivers on cable spans to create a small cell. Concealed Antenna Nodes (CANs) are easily placed and quickly deployed. Magic Box is a plug and play booster that receives and regenerates the signal within buildings but can cover up to 30,000 square feet inside and outside.

Sprint anticipates 5G service deployment beginning in 2019 and continuing into 2021-22. As was true for the transition from 3G to 4G, 4G will continue to be used and developed for many years even as 5G is deployed. 5G will likely be deployed first, where the network is experiencing traffic congestion that can be addressed by 5G's greater capacity. Sprint has somewhat unique position in that its network will be able to dynamically allocate traffic between 4G and 5G in its service areas.

The proposed T-Mobile–Sprint merger promises accelerated national deployment of 5G, which will also be deployed in fixed wireless configurations to compete with wireline broadband access services. T-Mobile has said that given approval of the merger, its 5G network will be deployed nationwide by 2020 and the merged company's 5G offering would support average speeds

nationwide of 450 megabits per second and 100 megabits per second to 90% of Americans. In a T-Mobile FCC filing, the company said that following a T-Mobile Sprint merger the new T-Mobile will introduce fixed 5G and expects to win 1.9 million customers by 2021, and 9.5 million by 2024, which would make it the country's fourth-largest home Internet Service Provider. By 2024, the company expects to be offering home internet service in 52 percent of U.S. zip codes. https://venturebeat.com/2018/09/21/t-mobile-details-5g-home-broadband-plan-to-undercut-charter-and-comcast/
https://www.telecompetitor.com/t-mobile-sprint-merger-will-unleash-new-cable-broadband-competitor-featuring-fixed-wireless/

Economic impacts of 5G Deployment
CTIA released a study on July 19, 2018, entitled "Accelerating Future Economic Value from the Wireless Industry," conducted by Accenture Strategy and commissioned by CTIA. The study finds reducing current timelines for 5G wireless infrastructure deployments by 12 months would unleash an additional $100 billion to the U.S. economy. It indicated the analysis builds on a 2017 study of the economic impact of 5G deployment and adjusted that model to estimate the impact of accelerated 5G deployment by streamlining of federal, state and local infrastructure rules for small cells - specifically, updating rules for small cell deployments in rights-of-way and creating reasonable fee structures for small cells.
https://prodnet.www.neca.org/publicationsdocs/wwpdf/71918ctia.pdf

The deployment of 5G technology will be a major disruptive event according to CMO Network. There are five key areas to watch including high bandwidth applications like immersive gaming and augmented reality. Forbes (8/14)

5G enabled applications
1. **Immersive Gaming.** 5G has many implications when it comes to gaming, and especially when it comes to gaming with augmented reality (AR) and virtual reality (VR). For example, 5G is likely to make VR less cost-prohibitive. When complex computing can be rerouted to the cloud (thanks to faster connections), it takes that stress of home devices, thereby making them more widely available at lower price points. 5G will also change how immersive AR experiences can be, making AR creatures within games smarter and better able to interact with the gamer's real-time environment—all with zero lag time.
2. **Autonomous Driving.** 5G will be mission critical to the already-growing field of autonomous driving. As infrastructures become more connected thanks to the IoT, processing bandwidth, reliability, and speed will not be matters of convenience, but matters of safety. It's called V-to-X, meaning these vehicles will be able to communicate with other vehicles, pedestrians, and their surroundings. To make autonomous driving and ultimately smart cities work it is all about data. It has to be processed faster and closer to the vehicle.
3. **Remote Robotic Surgery.** 5G will also impact telehealth enabling patient monitoring and clinical services to be delivered remotely. Ultimately, this could make best-in-class health care available to patients regardless of their geography.
4. **Production-Line Robotics**. As the Industrial IoT expands and is fueled by the capabilities of 5G, production-line robotics will be impacted in a big way. Currently,

these systems are steeped in automation function but are often hampered by the limits of network capacity and reliability. 5G takes those limitations away and allows production-line robots to perform complex computing and transfer data in real-time. This will be a game-changer from a workflow and supply chain perspective.

5. **Augmented Reality.** AR is becoming more mainstream, and 5G will be a major driver of that movement. As more AR apps are developed—including those that center around gaming, automotive video streaming, content production and distribution, and more—5G will deliver a seamless experience (even on mobile), enable social sharing (even from crowded venues), and much more.

MIT reported 5G could open $12.3 trillion in revenue across a number of industries, not just those listed above. When speeds increase anywhere from ten to 100 times over 4G with dramatically improved reliability, the performance of streaming and graphics, applications is enhanced.

https://www.forbes.com/sites/danielnewman/2018/08/14/5-emerging-technologies-that-5g-positively-disrupt/#7d7a046266b6

Small Cell Issues

As mobile wireless cell sizes are decreased, the number of cells needed to provide access to service is dramatically increased putting strain on permitting and construction efforts. The mobile wireless industry is working with municipalities to find a new paradigm. Twenty states have passed legislation to address this small cell challenge. Oregon is a "home-rule" state which establishes in the state constitution the rights of cities, municipalities, and/or counties the ability to pass laws to govern themselves if not pre-empted by state or federal law. Oregon cities are receiving small and macro cell siting permits, in the rights of way and on private land, are executing municipal pole use leases, and working collaboratively with the wireless industry.

The demand for cellular data is exploding. Carriers and infrastructure providers are deploying smaller equipment to bring antennas *closer to the end user* on utility poles, street lights and traffic signals. For property owners and managers, it's challenging to deal with the network operators, navigating the negotiation and procurement process.

For network operators, procuring property assets for small cell deployments has been a challenge. The key areas which either make deployment difficult or uneconomic, are:
- Identifying and acquiring sites with backhaul and power
- Rolling out the cells in a repeatable, affordable way
- Supporting neutral host or multi-operator platforms
- The use of third parties who find the locations and negotiate with property owners, which costs them time and delays the flow of rental income to property owners.

Industry is searching for ways to expedite and simplify this process of locating and acquiring access to locations.
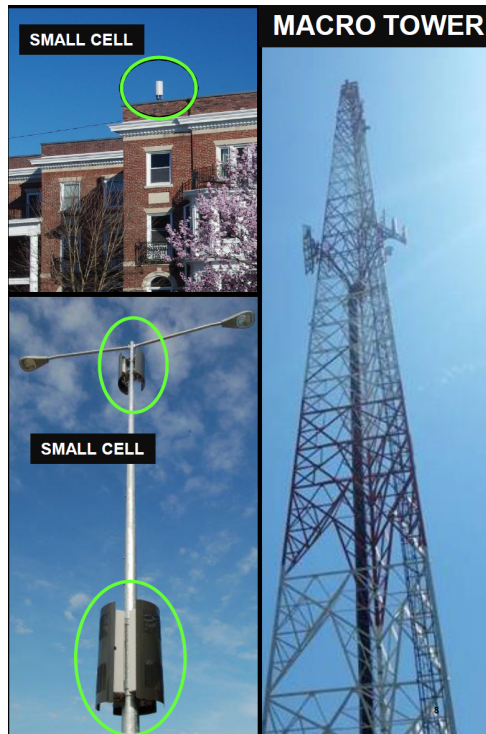
Small and Macro Cell Sites

Small cells are low-powered cellular radio access nodes that operate in licensed and unlicensed spectrum that have a range of 10 meters to under a kilometer. They are "small" compared to a mobile macrocell, partly because they have a shorter range and partly because they typically handle fewer concurrent calls or sessions. They make best use of available spectrum by re-using the same frequencies many times within a geographical area. Fewer new macrocell sites are being built. Larger numbers of small cells is recognized as an important method of increasing cellular network capacity, quality and resilience with a growing focus using LTE Advanced.

- 900: Number of cell towers in 1985
- 215,000: Total number of cell towers in US today
- Three will be 1 million + Estimated number of small cells needed for 5G and other networks in the next five to ten years

Municipalities are in a position to play a key role in small cell siting and network "densification."

The growing demand for wireless network infrastructure is coming from more than mobile carriers for 5G, but also public safety broadband networks, the Internet of Things, and developing Vehicle-to-Everything applications. Vehicle-to-anything (V2X) communications refer to information exchange between a vehicle and various elements of the intelligent transportation system (ITS), including other vehicles, pedestrians, internet gateways, and transport infrastructure such as traffic lights and signs. 5G is a high-profile driver of the need for small cell sites, but importantly, it is not the only driver.

This presents an opportunity for municipalities to evolve towards a simplified, standardized and repeatable set of processes to support the massive build-out:

- Pre-approve antenna configurations and site layouts to assist in streamlining the permitting process.
- Develop acceptable antenna attachment configurations for each pole type, including utility poles, street lights or traffic signals.
- Develop a wireless master plan that shows existing wireless infrastructure and a two-year buildout forecast, where industry provides siting data that is not proprietary.
- Continue to codify lease terms and antenna configurations in a Site License Agreement or another such instrument.
- Charge municipal pole use rental rates that are in the public interest, cost effective and agreeable for all parties.

It is an opportunity for municipalities to use their assets to get more connectivity. There is a massive build-out coming and municipalities will be challenged to manage the demand. Municipalities should consider how to process the inquiries an application that will be coming, they can be a neutral host.

Several states are considering legislation that would standardize the permitting process for sites. Local control is a key issue for cities in Oregon.

SmallCellSite.com is a portal that connects property owners with wireless carriers

- An industry portal creating a revolutionary **site acquisition marketplace** for wireless operators' small cell and 5G deployments.
- Large venue operators, small/individual property owners, and municipalities upload their assets with details like height, power, and property type.
- Fiber owners upload their information so wireless operators can leverage existing backhaul.
- Carriers adopt the site to search for viable attachment assets, from small cells to macro sites.
- By joining willing property owners, nearby fiber owners, and carriers, **the solution reduces friction by lowering carrier costs and accelerating deployments**

5G and small cell deployment are poised to follow 4G LTE wireless as a major driver of fiber deployment in Oregon going forward.

Oregon has the potential to become a center for technology development and deployment if it can help solve these issues. As usual, 5G infrastructure will go to where there is 5G demand first, and that will probably be the large metropolitan areas. It is a perennial challenge for local governments and broadband councils to find ways to close the divide. The challenge is that the current permitting and fees are tied to technologies and industry structures that have changed. [Timothy Downs, SmartGig Media, tdowns@smartgigmedia.com, Mobile: 949-235-8985]

Small Cell Permitting

On September 27, 2018, the FCC released a *Declaratory Ruling and Third Report and Order* to promote next generation—5G—network deployment, in its proceedings to accelerate wireless and wireline broadband deployment. In the Declaratory Ruling, the Commission cites to several court cases in finding that state and local fees, other charges, and additional requirements associated with wireless infrastructure "can unlawfully prohibit the provision of service." The Report and Order adopts "shot clocks" for municipal review of wireless infrastructure deployment and finds that a municipality's failure to act on applications for Small Wireless Facilities deployments within a 60-day review period will be cause for the Commission to constitute a presumptive prohibition subject to Commission preemption. (FCC 18-133)(WT Docket No. 17-79 and WC Docket No. 17-84).

The FCC's new small cell rules are intended to accelerate the deployment of small cell wireless network infrastructure. Among other things, the FCC small cell rules would limit what municipalities can charge for reviewing small cell deployments. Four key elements of the small cell rules, include:

- Preventing certain types of local requirements that "can materially inhibit of effectively prohibit small cell deployment."
- Allowing local governments to charge wireless providers for the costs of reviewing small cell deployment but proposing that fees represent a "reasonable approximation" of local governments' costs and providing specific fee amounts above which the commission would presume fees to be unlawful.
- Establishing "shot clocks" requiring local governments to conclude approval processes within 60 days for small cells being added to existing infrastructures and within 90 days when a provider wants to put up a new small cell pole. Approval requests would not be automatically granted if the local government fails to make a judgement before the deadline, however.
- Local governments would be allowed to continue to require "reasonable aesthetic reviews" of proposed small cell deployments.

https://www.telecompetitor.com/proposed-fcc-small-cell-rules-would-limit-fees-cities-can-charge-as-5g-rollouts-set-to-begin/

The U.S. Conference of Mayors "strongly opposes" provisions in the FCC report and order and declaratory ruling on wireline and wireless broadband deployment that it views as "subordinating local governments and their property rights to the benefit of the nation's communications providers."

The USCM Chief Executive Officer and Executive Director Tom Cochran said, "With little advance notice or engagement with local and state governments, the FCC action—which effectively prohibits local and state actions or policies having the effect of barring for some duration a private telecommunications company for accessing the public's rights-of-way—immediately disrupts local management regimes for the sole purpose of granting one group special federal protections and rights.

This ruling also upends a key provision of federal law that was enacted overwhelmingly by Congress in 1996 to protect and respect local and state government property rights and their authority to manage these public assets."

Small cell site permitting is part of the FCC's 5G Facilitate America's Superiority in 5G Technology (FAST) Plan which is intended to accelerate 5G deployment. Other elements include making additional radio frequency spectrum available and modernizing outdated legacy regulations including the repeal of Net Neutrality, a national policy for pole attachments, and providing an easier process of transition from Time Division Multiplexed (TDM) to Internet Protocol (IP) networks for carriers.
http://finleyusa.com/fcc-5g-fast-plan-encompasses-spectrum-infrastructure-and-regularity-issues/

The city of Portland has asked the U.S. Court of Appeals for the Ninth Circuit to overturn the FCC's recent declaratory ruling in its one-touch make-ready (OTMR) pole attachment proceeding. The city believes the FCC is exceeding its statutory authority. This issue is not a broadband issue, but one of jurisdiction and federal preemption of local regulatory authority.

In October 2018, the League of Oregon Cities participated with a consortium of wireless providers in a day-long meeting in Salem to discuss state and local issues regarding the deployment of small cell/5G technology. The purpose of the meeting was for cities and providers to share concerns and requirements regarding the deployment of new communications technology in a controlled setting in the hopes that areas of agreement could be identified and to make determinations where future collaboration might yield beneficial results. The meeting was attended by more than sixty city officials and wireless provider representatives. The League of Oregon Cities expressed that it is committed to continued engagement with its members and wireless providers to facilitate outcomes that ensure the equitable deployment of new broadband technology while protecting local management authority.

Improving Mobile Wireless Speeds
Mobile wireless transmission speeds continue to improve. Verizon customers enjoy the fastest mobile downloads in the U.S., followed by AT&T customers, according to a new study by Canadian-based mobile data company Tutela. Verizon had an average download speed of 21 Mbps with an average upload speed of 8.72 Mbps followed by AT&T at 14Mbps and 6.42 Mbps.
http://www.telecompetitor.com/study-verizon-has-fastest-mobile-downloads-at-20-82-mbps-t-mobile-takes-upload-crown/

Verizon plans to increase wireless speeds and capacity with technology upgrades. The company will provide carrier aggregation to subscribers in more than 2,000 markets and will add 4×4 Massive Input, Massive Output (MIMO) and 256 Quadrature Amplitude Modulation (QAM) technologies in over 1,100 markets.
https://www.verizon.com/about/news/verizon-continues-industry-leading-lte-advanced-network-deployments

Mobile Wireless Data

Mobile wireless data consumption continues to grow. According to a 2017 Ericsson Mobility Report, data traffic per user is expected to jump from 7.1 GB/month in 2017 to 48 GB/month in 2023, as operator networks are fast approaching capacity in many major metropolitan areas. It is not uncommon to face slowdowns at peak times in San Francisco, New York, Los Angeles, and other major cities.
https://www.ericsson.com/assets/local/mobility-report/documents/2017/ericsson-mobility-report-november-2017-central-and-eastern-europe.pdf

TV White Spaces for broadband

Fifty-seven legislators from both sides of the aisle in Oregon sent Federal Communications Commission (FCC) Chairman Ajit Pai a letter encouraging the agency to take action on TV white spaces creating designated unlicensed frequency bands. A similar letter was also sent by the Western Governors' Association.
http://westgov.org/images/editor/FCC_TV_White_Spaces_Letter_Chairman_Pai.pdf

The Cellular Telecommunications Industry Association (CTIA) predicts that over the next seven years, mobile wireless will generate $2.4 billion in Gross Domestic Product growth in Oregon's top ten cities alone. More than 14,700 5G related jobs will be created. There will be almost $1.3 million private sector network investment [see CTIA *Race to 5G* report https://www.ctia.org/news/race-to-5g-report]. Rick reported that Verizon has a project in Sacramento, California, to make that city the first 5G smart city in the country, and will be launching that network later this year. This project will be illustrative on the benefits of 5G to local communities. Other local communities that have been proactive may also serve as models.

E-mobility

Electro mobility (E-mobility) is a general term for the development of electric-powered drivetrains designed to shift vehicle design away from the use of fossil fuels and carbon gas emissions. The truck manufacturer Daimler says it will establish an automated truck research and development center at its North American headquarters on Swan Island in Portland where it already has an R&D presence including full scale wind-tunnel in Portland and a test track in Madras. The center will develop automated driving technology and study its impacts. Daimler is investing more than $500 million in e-mobility.
https://roboticsandautomationnews.com/2018/06/10/daimler-trucks-to-open-automated-truck-rd-center-in-portland-oregon/17591/

Fixed Wireless

The U.S. fixed wireless industry is comprised of more than 2,000 mostly small businesses that deliver reliable, affordable, high-speed broadband to customers in fixed locations such as residences, businesses, and community anchor institutions. In a typical Wireless ISP (WISP) network, middle-mile broadband transmissions are sent and received by the provider via fiber or microwave connections. The last mile is covered via wireless transmitters on towers or other tall structures like grain silos or water towers. Customers receive the content via small antennas that are attached to their premises.

According to a recent member survey, more than 75 percent of WISPA's operator members serve primarily rural areas and have fewer than 2,000 customers. More than half serve fewer than 1,000 customers. Significantly, almost all of our members have fewer than 25 employees, and almost 70 percent have 10 or fewer full-time employees. These are truly small, entrepreneurial companies with a local, rural, and small-town focus. [Claude Aiken, President/CEO, Wireless Internet Service Providers Association (WISPA)].

WISPA believes that Broadband fixed wireless economics are considerably better than those for fiber-to-the-home and that Congress should support spectrum policy favorable to WISPs. WISPs can deploy fixed wireless service to residential customers at about one-seventh the cost of FTTH and about one fourth the cost of cable. A key issue for WISPs is their ability to obtain licensed spectrum, and that ability could depend in large part on the rules that the FCC uses for two key upcoming auctions –the auction of Citizens Band Radio Service spectrum at 3550-3700 MHz and the C-band auction of adjacent spectrum in the 3700-4200 MHz band. WISPA advocates small license areas for the Citizens band auction, but large nationwide providers want large license areas.
https://www.telecompetitor.com/wispa-outlines-broadband-fixed-wireless-economics-policy-goals-before-congress/

"Fiber-in-the-Air" Technology
Qualcomm announced that it will work with Facebook to support Facebook Terragraph technology, a high-speed wireless offering designed for urban areas that Facebook has likened to "fiber in the air." Qualcomm said it will integrate Terragraph technology in its pre-802.11 ay Wi-Fi chipsets. Terragraph technology is designed to operate in an unlicensed portion of the millimeter wave band at 60 GHz. It uses multi-point multi-hop wireless technology based on client and distribution nodes designed for installation on what Facebook calls "street furniture" such as lamp posts and streetlights. Developers envision providing gigabit connectivity to single- or multi-family dwellings and 10 Gbps connectivity to apartment buildings and businesses. Facebook and Qualcomm said they expect to begin trials of the integrated solution in mid-2019.
http://www.telecompetitor.com/facebook-partners-with-qualcomm-on-terragraph-fiber-in-the-air-technology-aims-to-enable-gigabit-fixed-wireless/

IEEE has formed a new task group to work with manufacturers, operators and end users to build a global standard for light communications in wireless local area networking. The IEEE LiFi task group will focus on using solid state lighting, such as LED lighting, to wirelessly transmit high-bandwidth data. The task group, to be known as the IEEE 802.11 Light Communications Task Group will build on previous IEEE work.

The umbrella 802.11 task group includes a wide array of interests from across the telecom industry, with representatives from chipset providers like Qualcomm, Huawei, Broadcom and Intel; infrastructure providers, including Cisco, HPE, Nokia and Ericsson; and device manufacturers like Apple, Samsung, Sony and Panasonic, etc., noted the IEEE in a blog post.

The standards that the LiFi task group will focus on will be known as 802.11bb.

"IEEE 802.11 is ideally suited for LiFi because of the diversity, completeness, and proven track record of the ecosystem, as well as the Wi-Fi community's success in bringing technologies into standards and, more importantly, into products," according to the IEEE 802.11 Light Communications Task Group. According to IEEE, light communication is gaining ground because early uses show it is a viable global wireless solution particularly in EMI-challenged environments, such as hospitals, petrochemical plants, and airplanes, as well as in secure environments where RF is not sanctioned.

Another consideration, according to IEEEE, is that Light Communications will substantially improve indoor connectivity, in both office environments and, most significantly, in the home. Indoor connectivity accounts for four-fifths of all wireless communications.
http://finleyusa.com/ieee-lifi-task-group-created-to-pursue-light-communications/

Several major companies also announced plans to offer fixed wireless service—including Google, AT&T, Verizon and Windstream, the authors note. The report forecasts strong growth for the U.S. fixed wireless market, which is projected to grow from more than 4 million subscribers today to 8 million by 2021. Wireless ISPs typically serve rural areas that lack higher-speed broadband options such as fiber-to-the-premises or DOCSIS offerings. Fixed wireless technology typically supports speeds of 5 to 50 Mbps, but speeds continue to rise. The ideal area for fixed wireless service has 100 to 1,500 locations per square mile, according to the report.
http://www.telecompetitor.com/fixed-wireless-market-report-8-million-subscribers-by-2021/

Oregon has a number of established fixed wireless service providers.

Eastern Oregon Network, Inc. (EONI)
EONI operates in Union, Wallowa, and Baker counties, has 12 full-time and 2 part-time employees, and annual revenues of $2.5 million. It focuses on delivering high speed internet access, voice (traditional analog and digital), and hosted voice business phone systems and services. EONI has been expanding and growing. Recent and current projects include building one hundred miles of licensed microwave to serve Wallowa County, purchasing the Elgin grain elevator as a vertical asset, negotiating to purchase two small cable systems to deliver internet, building 2 more miles of fiber (taking us to 5 miles), and hosting one hundred voice end points by end of Q3 2017. www.eoni.com

FireServe
FireServe provides wireless broadband internet access, web hosting, server colocation, data center services and online backup services in the Klamath Basin including Klamath Falls, Merrill, Malin, Tulelake, Keno, Rocky Point, Chiloquin, Fort Klamath, in the Rogue Valley including Ashland, Central Point, Jacksonville, Medford, Phoenix, and Talent, and in Goose Lake Valley including Lakeview and New Pine Creek. It offers a range of high-speed internet access options, including wireless broadband access up to 100Mbps and dedicated business internet connectivity up to full GigE (1000 Mbps) speeds. https://www.fireserve.com/

Freewire Broadband
Founded in 2005, Freewire manages personalized business networks providing Event WiFi, internet access, and Software Defined Wide Area Network services in the Portland, Salem, and Eugene areas. https://gofreewire.com/

Rural Technology Group
Rural Technology Group (RTG) was founded in 2009 with the objective of bringing affordable true high-speed internet to the towns and rural homes of Sherman, Gilliam and Wheeler Counties. Using the data backbone that your county and the North Central Education School District (NCESD) originally built to support education and public safety, we deliver a fiber internet connection via a small wireless relay. The RTG high-speed network employs the most advanced fixed wireless technology in the region. It's "super-fast," always on, safe, and secure.

Windstream
Windstream fixed wireless services are now available to more than 350,000 businesses in more than 50 markets. Houston is the latest market to receive the service from the company. "Fixed wireless delivers secure connectivity and network diversity that virtually eliminates downtime which is a pressing concern for businesses," John Nishimoto, the vice president of product management for Windstream Enterprise, said in a press release. "We are seeing increasing demand for diversity solutions like fixed wireless particularly with governmental, public and healthcare entities responsible for the health and safety of its residents as well." The Windstream fixed wireless service complements Windstream's 150,000-mile core fiber footprint. It guarantees promised bit rates from 1.5 Mbps to 5 Gbps over a path-diverse route and service delivery times of less than 45 days, the company said. The platform supports SDN, IP voice, internet, MPLS and point-to-point services. Business continuity services are offered via a combination of fiber and fixed wireless. Fixed wireless is seen as a significant tool because it reduces the costs of providing service to difficult-to-reach endpoints. The attraction of the technology is expected to grow in the era of 5G. The faster networks are able to provide more functionality and serve more homes and businesses.
https://www.telecompetitor.com/windstream-fixed-wireless-now-available-to-more-than-350000-businesses/

Eastern Oregon Telecom
Eastern Oregon Telecom, headquartered in Hermiston, offers fixed wireless internet access services to Hermiston, Umatilla, Boardman, Irrigon, and Plymouth with download speeds up to 20 Mbps. http://www.eotnet.com/

AT&T
AT&T said it will deploy fixed wireless service beginning in late 2019 using spectrum in the CBRS band. AT&T CBRS fixed wireless deployments will target parts of "U.S. cities" where fiber cannot cost-effectively reach homes and businesses. In addition, a company spokesperson said the company will use the CBRS band for fixed wireless deployments. Those deployments are primarily in rural areas. AT&T has **been deploying** fixed wireless in rural areas where it received funding from the FCC Connect America Fund to cover costs. Until now, that service has used licensed WCS spectrum in the 2.3 GHz band and had provided relatively low speeds in comparison with fiber—10 Mbps downstream and 1 Mbps upstream.

https://www.telecompetitor.com/att-cbrs-fixed-wireless-deployments-will-offer-residential-broadband-alternative/

Competitive Access Providers

Oregon has a thriving competitive access provider industry segment that includes the following service providers.

Ashland Home Net

Ashland Home Net (AHN) is a community based, locally owned and operated, "Net Neutral," Internet Service Provider specializing in connecting people to the high-speed internet service provided by Ashland Fiber Network. AHN is Ashland's largest ISP and it also has bundled voice service and cable TV available. www.ashlandhome.net

Comspan

Comspan provides advanced video, high-speed internet, and telephone services to families, small and medium sized businesses, hospitals, schools and government offices in select rural communities in Southern and coastal Oregon. Comspan was founded and is headquartered in Roseburg. http://comspan.net/

Douglas FastNet

Douglas Electric Cooperative (DEC) serves about 10,000 electric meters in bucolic Douglas County as well as parts of nearby Coos and Lane Counties, across a service area covering 2,200 square miles in southwest Oregon. Douglas Fast Net (DFN), DEC's for-profit telecommunications subsidiary, built and operates the local fiber communications network. DFN was created in 2001 to bring advanced telecommunications to Roseburg and the surrounding areas of Douglas County. Since then, the company has become a leader in fiber-optic voice and data services, becoming one of the first providers in Oregon to offer internet speeds up to 1 gigabit per second (Gbps) to the rural residential market. DFN has invested nearly $25 million with more than 1,450 miles of fiber-optic communications network that offers broadband internet access to a population of approximately 56,000 in sixteen cities and towns across southwest Oregon. In addition, a regional high-speed network, co-owned by DEC with four other Oregon electric cooperatives and operated by LS Networks, serves as the regional backbone for the local communication networks built by entities such as DFN (see sidebar). DEC recognized early on the risk that economic growth in rural areas would be stymied by lack of high-speed internet access, digital voice communications and data transfer capacity and took a leadership role in addressing it. https://dfn.net/

Eastern Oregon Telecom

Eastern Oregon Telecom offers fixed high-speed internet access and voice services over fiber, coax, and fixed wireless technologies to Hermiston, Pendleton, Umatilla, McNary, Boardman, Irrigon, and Plymouth with download speeds up to 1 Gbps, and upload speeds of up to 100 Mbps. Symmetrical Gigabit service is available for commercial customers. http://www.eotnet.com/

Fatbeam

Fatbeam delivers fiber-based solutions to education, business/enterprise, healthcare, and government customers in rural and mid-sized communities in the western United States. We offer Dark Fiber, Lit Fiber/Ethernet and Gigabit Internet to expand connectivity and increasing bandwidth needs. Fatbeam recently announced new financing and the purchase of the IP Connect division of Ednetics, which offers technology solutions to the educational and public-sector markets. With this acquisition, Fatbeam will add customers in Idaho, Oregon, and Washington, as well as a core broadband internet service offering that the company will integrate and offer across its entire footprint. www.fatbeam.com

GorgeNet

Gorge Networks was founded in 1994 as the first company to provide internet service in Hood River, Oregon and has grown to be an established local service provider for businesses and residents of the mid-Columbia region offering voice, data, and telecom consulting services. http://www.gorge.net/

Hunter Communications

Hunter Communications was founded in 1994 as an Oregon based competitive local exchange company (CLEC), telecommunications and construction company providing service for local area networks and wide area networks in Southern Oregon. Hunter's 1,500 route mile fiber backbone and last mile infrastructure connects Oregon's educational systems, healthcare facilities, cellular networks, financial institutions, city and county governments, and businesses of all sizes throughout Oregon to a dependable, commercial grade communications network. Additional fiber construction and growth is being made into California to expand their footprint and deliver services and connectivity. Hunter, utilizing new high-tech phone switching, also has the capability to provide enterprise level voice services, which combined with their fiber optic backbone provides a robust platform with the ability to provide a full range of telecommunications services. www.hunterfiber.com

InfoStructure

InfoStructure is a full-service provider of voice, data and cloud services using "best in class" communication and collaboration technology. InfoStructure provides a suite of traditional, Unified IP and software services ranging from TDM, SIP trunking and Hosted PBX to Ethernet, Managed IT and SD-WAN. www.infostructure.net

OnlineNW

OnlineNW is the largest local provider of internet solutions for the mid-valley region. The company is community oriented and has partnered with Innovate Oregon and local communities on bold initiatives to address education challenges and to deliver 10 Gigabit speeds in some service areas. www.onlinenw.com

LS Networks

LS Networks is owned by a collection of cooperatives backed by 70,000 Oregonians. The company operates a fiber optic backbone and an MPLS core throughout Oregon, Washington, and Northern California.
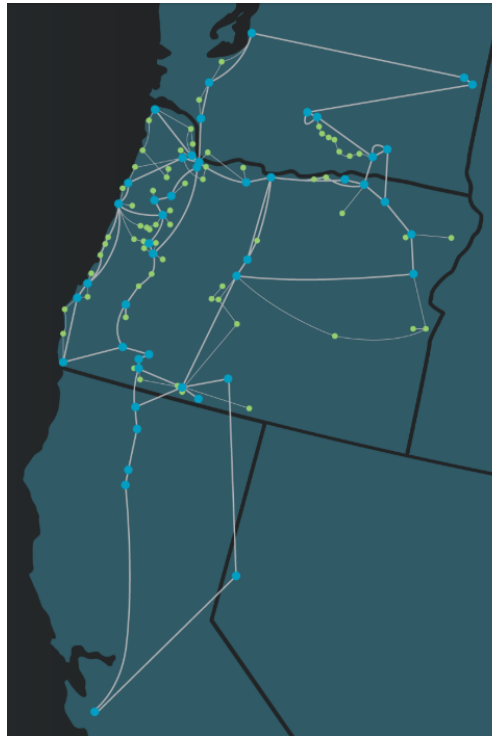
LS Networks—Washington-Oregon-California Network Map

PEAK Internet

PEAK is a locally based Commercial Grade Internet Service Provider headquartered in Corvallis, where it employs over 50 people and serves over 10,000 customers. PEAK provides high speed Broadband access to the Willamette Valley and Central Coast. PEAK offers a wide range of services including residential high-speed internet access (Fiber-to-the-Home, DSL, and Fixed Wireless), Commercial Internet access, Website Hosting, Engineering, Networking, Design, and Construction, Data Center and Colocation Services, and application-based Video Services. www.peakinternet.com

Q-Life

QualityLife Network dba Q-Life, is a collaborative effort of public entities in The Dalles, Oregon, who created a 33-mile fiber optic loop through the city. The goal is to enhance the region's economic development efforts with a reliable, cost effective, open access link to the Bonneville Power Administration's fiber, which runs through The Dalles. Q-Life is a middle mile provider of fiber services in Wasco County. This year, Q-Life has expanded its network to the city of Maupin with a fiber-to-the-home project that will make Maupin Oregon one of the most wired cities in the state. Q-Life is consistently looking to develop partnerships with service providers and other government entities to expand fiber resources in the region. www.qlife.net

Wave

Wave operates a large and growing regional fiber network on the West Coast with 8,500+ route miles of metro fiber stretching from the Canadian border to major hubs in Seattle, Portland, Sacramento, and the greater Bay Area. Wave provides voice and data connectivity solutions with speeds up to 100 Gbps, including Direct Internet Access, Ethernet Transport, Dark Fiber,

Wavelengths, and Colocation. In addition, Wave manages the Tillamook Lightwave ocean cable landing station in Pacific City, OR, where transpacific traffic is transported from the landing station to Hillsboro and can be distributed to six data centers. Multiple undersea cables from Northern Asia and Australia/New Zealand land in Tillamook County and utilize Wave's diverse terrestrial fiber routes from the coast to the Portland Metro area and beyond. In early 2018, following an acquisition by TPG Capital, Wave joined forces with RCN Telecom Services, LLC and Grande Communications to create the sixth largest U.S. cable operator.
www.wavebusiness.com

Windwave
Windwave is a community driven, locally-owned fiber-optic communications company headquartered in Heppner. In business since 2004, it serves several regional markets in Eastern Oregon. Windwave's network utilizes over 1,000 route miles of company-owned or controlled optical fiber. Windwave is a wholly-owned subsidiary of Inland Development Corporation, an Oregon nonprofit corporation dedicated to providing advanced broadband facilities and services to schools, hospitals, and government entities in underserved areas. Windwave's relationship with Inland means that 100% of its after-tax profits are reinvested into the communities it serves.
http://www.windwave.org/

Zayo Group
Zayo, founded in 2007, has $2.6 billion in annual revenue, serves 391 markets with 11.5 million miles of fiber, 34 thousand buildings, 51 data centers and over 3,600 employees in North America and Europe. Zayo offers dark fiber solutions, which provide our customers with dedicated high-capacity, low-latency bandwidth. In addition, Zayo's offerings include managed bandwidth, lit fiber-based solutions, including wavelength, Ethernet, IP and video solutions, and cloud connectivity. Zayo monitors performance across its network from an advanced 24/7/365 Network Control Center. Zayo has achieved much of it rapid growth through acquisition with 41 acquisitions since 2008 totaling more than $6.5 billion.

Zayo has been actively growing its network in Oregon including the acquisition of Electric Lightwave, 360 Networks, AboveNet, and Northwest Telephone Inc. Key metro markets for Zayo in Oregon include Portland/Hillsboro, Eugene, Salem, Bend, and Pendleton/Umatilla. Key "long haul" inter-city routes for Zayo include Seattle to Portland. In 2017, Zayo announced its Portland to Umatilla route which added more than 250 route miles along the Hood River corridor, which has become a data center hub for major content companies and carriers. The route is fully underground.

Zayo also announced a new network expansion in February, a new long-haul dark fiber network between Reno, Nevada, and Umatilla, Oregon. The route is anchored by a webscale customer and is generating strong demand from additional customers. The network expansion will add more than 600 route miles along the western U.S. and adds to the Portland to Umatilla route announced last year. The route, which will be fully underground, connects the two cities via Mitchell, Prineville, and Paisley and will take about two years to complete. The expansion creates a diverse route between Portland and other major cities on the West Coast
http://investors.zayo.com/news/2018/02-07-2018-130213959.
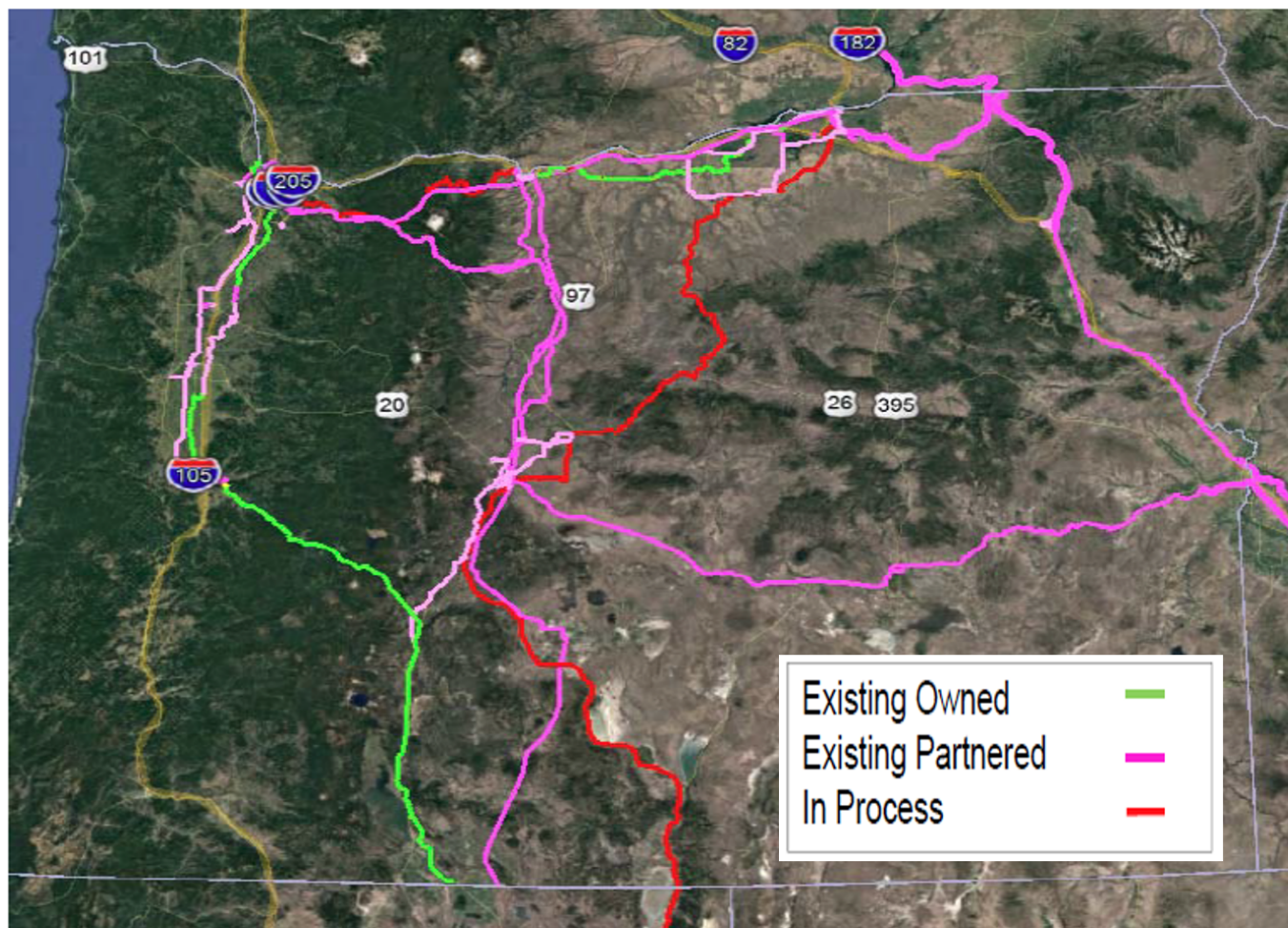
Zayo Oregon Long-Haul Network Map

Zayo has reported that new network construction permitting in Oregon is relatively good compared to other states.

Satellite Companies
Significant game changing developments are occurring in the satellite industry. Today's Satellite Broadband technologies and service levels are dramatically different than when internet access services were introduced and enable broadband connectivity at locations miles away from terrestrial infrastructure.

Satellite broadband services have been around for many years and the perceptions of prospective users are often of first generations services, not what is currently available. Two new satellites were launched in 2017 by HughesNet and ViaSat. Satellite service providers are now delivering fast, secure, reliable, competitively priced, high speed broadband at 25 Mbps down and 3 Mbps up that is available everywhere in the continental U.S., and without hard data limit. Satellite systems are also capable of delivering faster speeds and should soon be accompanied by unlimited data plans. Approximately 2 million customers subscribe at reasonable rates to speeds that meet the FCC's definition of broadband service.

With the deployment of the next generation of technology and its improved performance and capacity, satellite providers are in the process of ramping up their local dealer networks. A growing number of applications are using satellite as a redundant back-up access system to terrestrial services, and for Disaster Recovery. The industry works with the Information Disaster Resource Center https://itdrc.org/ to provide emergency deployment of services to areas hit by natural disasters to provide services to emergency centers, medical centers, government, and other key users. There are currently eighteen deployments in Texas and forty deployments in Puerto Rico. More than 250,000 hours of service have been donated since 2015.

In the future, higher capacity satellites will be launched in 2019. Both Hughes and ViaSat expect to be delivering 100 Mbps service nationwide with over five times the capacity of current satellites. The industry will continue to make significant investments to improve services in underserved markets.

Satellite Service Providers

Satellite broadband service providers are dramatically improving the performance of their networks. ViaSat has announced the availability of 100 Mbps satellite-based broadband service. The ViaSat 100 Mbps service is now available with unlimited data plans. The service is powered by the ViaSat-2 satellite system, which uses an advanced, high-capacity communications satellite, coupled with new innovations in satellite ground infrastructure. In addition to the 100 Mbps plan, the company also offers plans with speeds of 12 Mbps, 25 Mbps, 30 Mbps and 50 Mbps.

ViaSat's new high-end tier, called Unlimited Platinum 100 and optimized for HD video streaming, carries an introductory price of $150 per month (with in-home WiFi included), and rises to $200 per month after three months.

- Unlimited Bronze 12: Up to 12 Mbps, starting at $50 per month ($70 per month after three months)
- Unlimited Silver 25: Up to 25 Mbps, starting at $70 per ($100 per month after three months)
- Unlimited Gold 50: Up to 50 Mbps, starting at $100 per month ($150 per month after three months)

http://www.telecompetitor.com/viasat-100-mbps-satellite-broadband-offers-an-improved-broadband-experience/

There are also prospects for new low earth-orbit satellite network and service providers. SpaceX has received FCC approval to offer lower-latency satellite broadband service in the U.S. SpaceX FCC approval paves the way for the company to provide broadband service in remote areas lacking equivalent terrestrial-based offerings. Other companies that have received FCC approval include Space Norway, OneWeb, and Telesat.
http://www.telecompetitor.com/spacex-gets-fcc-approval-lower-latency-satellite-broadband/

SpaceX's plan is to deliver broadband services directly to customers anywhere in the United States or around the world at speeds similar to some of the quickest ground-based internet connections. SpaceX projected the satellite-internet business would have more than 40 million subscribers by 2025. http://money.cnn.com/2018/02/18/technology/future/spacex-launch-paz-demo-starlink/index.html

Facebook is among a host of companies developing low earth orbit satellite systems that could eventually provide service to half of the world population. Facebook plans to launch its internet satellite Athena to provide broadband access to unserved and underserved areas according to an application the company filed with the FCC under the name PointView Tech LLC. https://www.wired.com/story/facebook-confirms-its-working-on-new-internet-satellite/

Municipalities
Cities of Monmouth and Independence MINET
MINET Fiber, a fiber optic telecommunications provider since 2006, is located in the cities of Independence and Monmouth and is working to expand connectivity to surrounding communities. MINET provides both Fiber Powered residential Internet, TV and Telephone services to Monmouth-Independence residents and a wide spectrum of Broadband Services to Oregon businesses and Governmental agencies. The city of Independence has been engaged in broadband adoption and utilization, and application development to leverage the MINET fiber network. Partnerships have been established with the technology industry and agricultural groups to develop and pilot broadband enabled technology applications for agriculture. The city established the Independence Test-Drive program which provides physical office space and Gigabit MINET connections, at no charge, to companies or organizations wanting to test and develop Gigabit applications while connected to an in-service Gigabit network. www.minetfiber.com

City of Dallas
MINET has entered in to a partnership to build Willamette Valley Fiber, a new fiber-to-the-home network in the city of Dallas. MINET will operate the network. The network should be in service by the end of 2018.

City of Sandy SandyNet
SandyNet is a municipal internet service provider, began offering service in 2003, and is owned and operated by the city of Sandy. SandyNet has built and operates a fiber-to-the-home network throughout the city serving residents, businesses and all information technology services for the city. It offers symmetrical broadband service at 300 Mbps for $39.95 per month and at 1 Gbps for $59.95 per month achieving a seventy-percent take rate in the community. SandyNet also provides wireless high-speed internet access service for rural areas surrounding Sandy via WiFi. https://www.ci.sandy.or.us/sandynet

Cities of Dayton and Willamina
The city of Dayton was touted as the first 10 Gig city on the west coast upon turn up of its 10 Gig fiber network, a project of Innovate Oregon, the city of Dayton, and Online NW in a public-private partnership to develop and market a Gigabit network and turn Dayton into a Gigabit city. The community is using a strategy to build an innovation ecosystem across schools, nonprofit

organizations, local businesses and government. The network architecture includes an optic-fiber cable backbone with fiber to key locations and a fixed wireless distribution network throughout the community.

A second 10 Gig fiber network project is underway in Willamina, with completion scheduled for the end of the year, using the same integrated framework that was pioneered in Dayton. Dayton's school has become a model for school districts around the state for preparing students to be makers and creators in new innovation economy.

Cooperatives

Electric Cooperatives offer one of the best prospective solutions for broadband in rural America. Earlier this year, the National Rural Electric Cooperative Association, the national trade association representing more than 900 local electric cooperatives, released a study with key findings for its membership. It found that the lack of broadband access for 6.3 million electric co-op households results in more than $68 billion in lost economic value for the communities served. Further, electric cooperatives are well positioned to help solve the rural broadband digital divide. The very model that was successful in bringing electricity to rural America in the 20th Century, may be applied to bringing broadband to rural America in the 21st Century.
 [NRECA New Release September 10, 2018]

Electric cooperatives are well positioned. They have distribution facilities and service delivery organizations in place and may already have broadband backbone communications systems that are used to manage the electric grid providing supervisory command and control. Electric cooperatives are located in rural areas where the broadband service gaps exist and can deliver the broadband services needed to meet the needs of their members and support the economic sustainability of the communities they serve, and in turn, their own long-term viability.
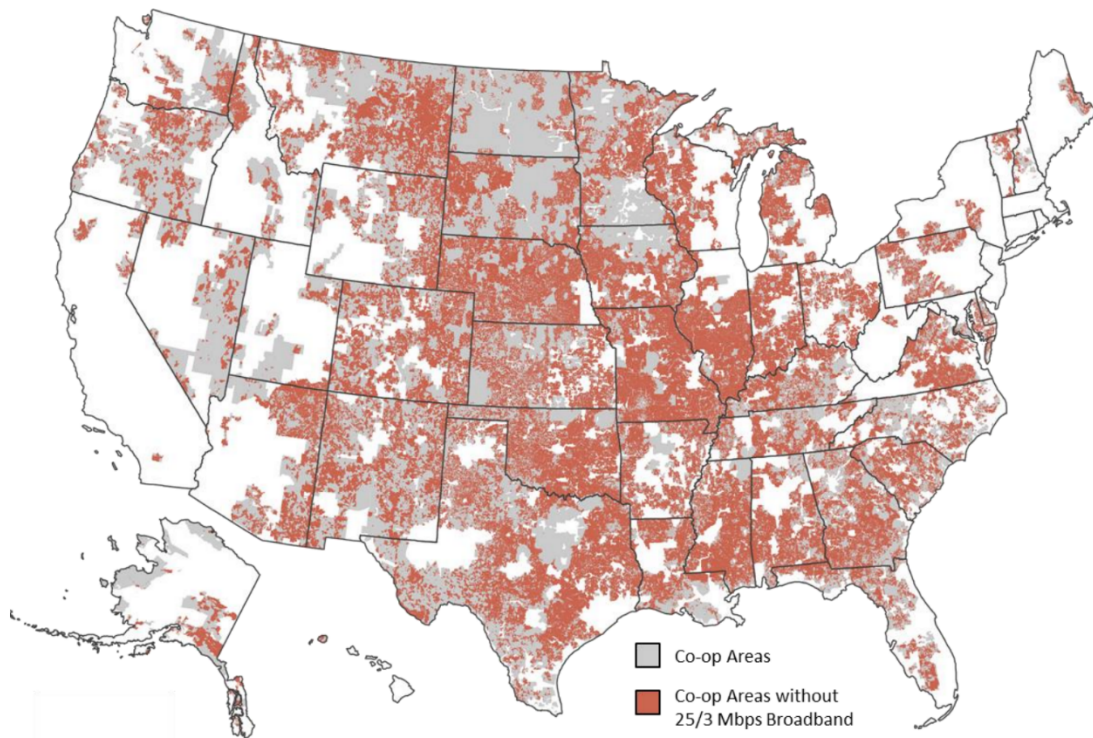
Electric Cooperative Areas without Access to 25/3 Mbps Broadband–NRECA

There are seven Electric Cooperatives in Oregon that are engaged in providing broadband internet access services:

- Umatilla Electric Cooperative, Hermiston—one of the owners of LS Networks and the former owner of Eastern Oregon Telecom.
- Hood River Electric Cooperative, Odell—one of the owners of LS Networks and operates the Communications Access Cooperative Holding Enterprise (CACHE).
- West Oregon Electric Cooperative, Vernonia—one of the owners of LS Networks.
- Central Electric Cooperative, Redmond—one of the owners of LS Networks.
- Douglas Electric Cooperative, Roseburg—one of the owners of LS Networks. Owns Douglas FastNet and was a former partial owner of Eastern Oregon Telecom.
- Consumers Power, Philomath—joint owner (with Pioneer Telephone Cooperative) of Casco Communications that owns Peak Internet.
- Columbia Basin Electric Cooperative, Heppner—owner of the newly formed Columbia Fiber LLC. CBEC is between the feasibility phase and design phase of implementation.

In addition, the following electric cooperatives are evaluating providing broadband services:

- Coos-Curry Electric Cooperative, Port Orford—studying whether or not to provide broadband.
- Harney Electric Cooperative, Hines—participating in the Harney County Broadband Planning Project.
- Lane Electric Cooperative, Eugene—board giving some preliminary consideration of studying providing broadband.

Electric cooperatives becoming broadband internet access service providers is gaining traction. Electric cooperatives, like telecom cooperatives, tend to be community-focused—and when their communities lack high-speed broadband, they often undertake deployments on their own or through partnerships with neighboring telecom co-ops. Rural communities have become increasingly aware of the importance of modern broadband infrastructure to support economic development and for quality of life. https://www.telecompetitor.com/electric-cooperative-gigabit-gains-traction/

Electric co-operatives are likely to play an increasingly important role in deploying the technology, according to rural utility lender CoBank in a new report *titled Making the Move Into Broadband: Rural Electric Co-ops Detail Their Experiences,* CoBank includes case studies of six electric co-op broadband deployments and explores what made them successful. https://www.cobank.com/-/media/files/ked/power-energy-and-water/making-the-move-into-broadband--sep-2017.pdf

This year, a Rural Electric Cooperative Consortium was awarded $186 million in CAF II funding for Gigabit Broadband making it the third largest winner overall and the largest winner that pledged to build out service supporting gigabit service over a period of ten years. Twenty-one rural electric cooperatives including Douglas Electric of Roseburg, Oregon, submitted the joint bid. https://www.telecompetitor.com/how-the-rural-electric-cooperative-consortium-won-caf-ii-funding-for-gigabit-broadband/
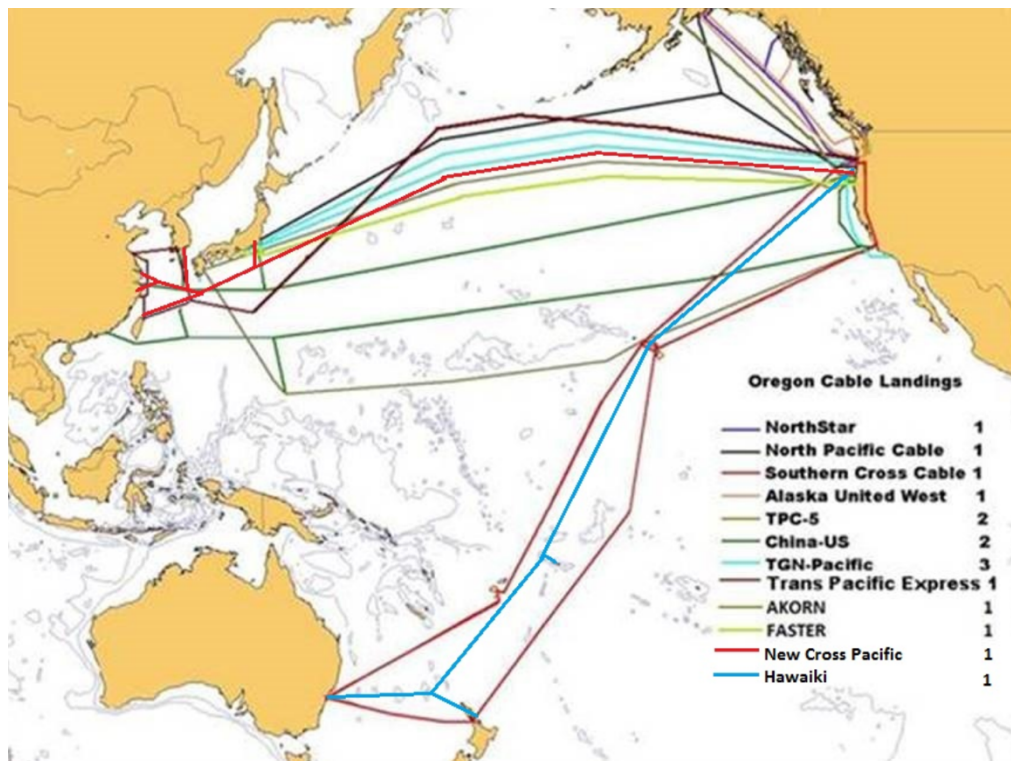
Undersea Cables

Oregon Undersea Cable Landings 2018

There are currently fifteen, soon to be sixteen in-service commercial undersea cables coming ashore in Oregon with additional cable projects currently under development. Oregon is a preferred location to come ashore on the West Coast of North America because of a well-established working relationship between state government, the fishing fleet, and the undersea cable operators.

> "Oregon is probably the best state on the U.S. West Coast to land a submarine cable. The coast is relatively safe, the state permitting process is efficient and most importantly, our customers like Oregon's diversity and easy access to U.S. networks and data centers"
> — Gina Bohreer
> Senior Vice President North America,
> Hawaiki Cable

This growing cluster of undersea cables is positioning Oregon as a telecommunications gateway to the Pacific Rim. There is an ongoing opportunity to promote Oregon for future cable landings, related on-shore operations, and as a preferred location for any business or organization needing high-bandwidth connectivity to the Pacific Rim. Undersea telecommunications cables and their interconnections add valuable infrastructure to the state. Undersea cables bring permitting and easement fees, contract work for the fishing fleet, and the potential of long-term jobs to manage and maintain the cables and the networks. An open letter from Governor Kate Brown to the delegates of the Pacific Telecommunications Conference in January of this year seeks to promote this positive working relationship.

January 5, 2018

Delegates
Pacific Telecommunications Conference
Honolulu, Hawaii 96826

RE: Trans Pacific Undersea Cable Projects

Ladies and Gentleman:

We invite and encourage you to consider the State of Oregon as your future site to come ashore on the west coast of North America, and as an excellent location for the placement of related on-shore operations. Oregon has a long record of successful submarine cable industry projects, a highly developed telecommunications infrastructure, a workforce of skilled professionals for marine and terrestrial telecommunications cable installation, and unparalleled cooperation between its undersea cable operators, fishing industry, and state government.

As chair of the State Land Board, which approves easements for cable landings on the Oregon coast, I can assure you that we will welcome and give full and timely consideration to all landing requests. Please know that the Department of State Lands and the Oregon Business Development Department along with other involved state agencies will work in partnership with you, as an undersea cable operator, and Oregon's fishing fleet to ensure the success of your project once approved.

Please contact Chris Castelli, Oregon Department of State Lands, 775 Summer Street NE, Salem, OR 97301-1279 USA; phone: 503 986-5280; e-mail: chris.castelli@state.or.us, for more information.

We stand ready to assist you and to provide you with the information you need to come ashore in Oregon.

Sincerely,

Governor Kate Brown

KB:jkt

Letter from Governor Kate Brown to the Delegates of the
Pacific Telecommunications Conference

In July 2018, Hawaiki Cable announced that its trans-Pacific cable construction has been completed and that the cable is ready for service with 43 terabits of new capacity offering greater connectivity, diversity and price competition in the Pacific region. The $300 million, 15,000 km fiber optic undersea cable links Australia, New Zealand, American Samoa, the Pacific and United States landing in Pacific City Oregon. Hawaiki has also included several stubbed branches to enable the future connection of New Caledonia, Fiji, and Tonga.

South Pacific nations are seeing demand for capacity growing by 45% year-on-year. Hawaiki has been specifically-designed to meet these expanding requirements, providing infrastructure to support critical applications such as business-grade cloud services, real-time content delivery and ultra-low latency networks. New Zealand's leading university and research collaboration body, REANNZ has secured a 25-year anchor tenancy on behalf of the NZ Government, providing a major boon for the organization.

The New Cross Pacific Cable also landing in Pacific City and connecting to Japan, Taiwan, Korea and mainland China is also scheduled for completion this year with several others in the pipeline. One of those in development is the Jupiter Cable, which is planning to come ashore in Oregon, site yet to be selected, connecting to Japan and the Philippines and placed into service in 2020. Jupiter will also have an undersea leg down to Los Angeles. This project also illustrates the growing participation of content companies in network infrastructure projects, the owners include Facebook, Amazon, and Nippon Telegraph and Telephone of Japan.

Private Sector Investment

Telecommunications has been described as a natural monopoly due to the capital-intensive nature of the industry. Capital expenditures by wireline, wireless, and cable broadband providers grew from $74.8 billion in 2016 to $76.3 billion in 2017, an increase of 2%, according to a report by the U.S. Telecom Association.

The wireless telecommunications industry, directly and indirectly, contributed $475 billion to the U.S. gross domestic product in 2016, according to a new wireless economic impact study conducted by Accenture for CTIA—The Wireless Association. That figure represented 2.6% of U.S. GDP for the year. The wireless industry also supports 4.7 million U.S. jobs, including direct and indirect jobs. These findings are based on data from the U.S. Bureau of Labor Statistics and the U.S. Bureau of Economic Analysis. The wireless industry's indirect economic impact is stronger than that of some other major industries, researchers found. They noted, for example, that each direct wireless industry job results in 7.7 total jobs throughout the economy. That 7.7 number is known as the employment multiplier effect. In comparison, the employment multiplier effects for hardware manufacturing and full-service restaurants are 3.9 and 1.5, respectively.

AT&T has invested over $250 Million in its Oregon wireless and wired network infrastructure during 2015–2017. In 2017, AT&T made more than 1,200 wireless network coverage, capacity and speed upgrades in Oregon; adding new cell sites, expanding its 4G LTE footprint, and deploying multiple new in-building and outdoor distributed antenna systems.
https://engage.att.com/oregon/blog/?PostId=4953

In Oregon, CTIA cites impacts of 46,455 wireless related jobs, $2.3 Billion in pay and benefits from the wireless telecommunications industry, and a $5.6 Billion impact on GDP.
http://www.telecompetitor.com/wireless-economic-impact-study-industry-contributes-475-billion-annually-to-u-s-gdp/

Cable company Charter Spectrum serves 96 communities in Oregon, has more than 400 jobs in the state which support over 2,300 indirect jobs. Charter estimates that it has a $311 impact on State Gross Domestic Product.

These investment levels by the private sector underscore the size and scope of deploying and maintaining a broadband network infrastructure.

Internet Access Service Trends

The FCC's Wireline Competition Bureau issued its Internet Access Services Report on February 7, 2018, which summarizes information on internet access connections in the United States as of December 31, 2016, as collected by FCC Form 477. The report indicates internet connections increased by about six percent between December 2015 and December 2016 to 376 million, and most of the growth in total internet connections is attributable to increased mobile internet access subscribership. Mobile internet connections increased seven percent year-over-year to 270 million in December 2016, while the number of fixed connections grew to 106 million—up about three percent from December 2015.
https://prodnet.www.neca.org/publicationsdocs/wwpdf/020718internetreport.pdf

A new report from the Pew Research Center finds that 20% of Americans exclusively use their smartphones at home for internet access—they don't subscribe to a traditional wireline broadband service. The figure shows a strengthening of this smartphone-only homes trend. According to Pew, only 13% of Americans in 2015 said they were smartphone-only users. Meanwhile, 65% of Americans told Pew that they have traditional broadband service in their homes, similar to the 67% figure reported in 2015.

Pew also reported that people who rely on their smartphones for home internet service tended to have lower incomes than their broadband-subscribing counterparts. Thirty-one percent of Americans with an annual household income of less than $30,000 are smartphone-only internet users, more than three times the share among those living in households earning $75,000 or more per year (9%). http://www.telecompetitor.com/pew-smartphone-only-homes-grow-now-1-in-5-use-smartphones-exclusively-for-internet-access/

Pew Research has announced a new broadband research initiative that will focus on identifying how states have addressed gaps in broadband connectivity. Pew will conduct research on broadband access and expansion, including the economic impacts of broadband and the collection, verification, and visualization of connectivity data. Pew plans to convene government, research, and industry leaders and other stakeholders for data-driven discussions about improving broadband access.
http://www.pewtrusts.org/en/projects/broadband-research-initiative

Purdue University research published research in August concluding that rural Indiana would benefit from broadband connectivity. The report finds that for each dollar invested in rural broadband, $4 will go back into the economy through increased tax revenue and healthcare savings. The analysis found if investments in broadband were made statewide, Indiana would see about $12 billion over a 20-year period. And Purdue University agricultural economics professor Wally Tyner says that's a conservative estimate.
https://indianapublicmedia.org/news/purdue-study-rural-broadband-could-translate-to-billions-of-dollars-if-extended.php

A newly released National Rural Electric Cooperative Association (NRECA) study found that the lack of broadband access for 6.3 million electric co-op households results in more than $68 billion in lost economic value, according to new research by the National Rural Electric Cooperative Association (NRECA). The new report investigates the cost of the digital divide and the growing economic advantages to America's rural communities. High costs and low population density are two barriers to rural broadband deployment. Nonetheless, roughly 100 electric cooperatives are bridging the digital divide and bringing broadband to their communities.
https://www.electric.coop/

The Michigan Consortium of Advanced Networks (MCAN), established by the state of Michigan, issued a report entitled, *Michigan Broadband Roadmap*. MCAN's goals include enabling all homes and businesses in the state to have broadband at speeds of at least 25 Mbps upstream and 3 Mbps downstream available to them by 2022 and speeds of at least 1 Gbps by 2026. In addition, MCAN aims to see a 95% broadband adoption rate for the state by 2024.

Recommendations include using a $20 million Connecting Michigan Communities grant to support between 50 and 100 projects annually that fund targeted investments that use broadband in innovative ways to increase economic activity. Priority will be given to proposals that are part of a comprehensive economic development strategy and that involve collaboration between broadband providers, municipalities, anchor institutions, philanthropic organizations and similar entities. Another recommendation is to create an annual $500,000 fund to provide matching dollars to schools applying for **E-Rate funding** from the Universal Service Fund schools and libraries program. https://www.telecompetitor.com/michigan-broadband-roadmap-lots-of-ideas-for-improving-availability-adoption/

Oregon Broadband Infrastructure Projects

Cities
Glendale
The city of Glendale and Douglas Fast Net are proposing a public-private partnership to deploy a fiber to the home (FTTH) and fiber to the business (FTTB) network within Glendale's city limits. The DFN operated fiber network will provide gigabit capable speeds to the homes and businesses throughout the city. Ethernet Transport services and voice services will also be made available as a result of this project.

Hillsboro
Hillsboro announced plans to extend an existing, city-owned fiber-optic network to serve residents and businesses. The city says it can offer superfast internet connections for about $50 a month—or as little as $10 a month for low-income residents. Hillsboro expects service will be available in some areas as soon as next spring. Pending City Council approval at the end of the month, Hillsboro would allocate $4 million next year, and another $4 million in each of the subsequent five years, to begin a fiber buildout. City officials say a citywide system could take a decade to complete. http://www.oregonlive.com/silicon-forest/index.ssf/2018/05/hillsboro_reverses_course_plan.html

The city council took steps toward building a municipal gigabit internet access network this month approving a plan to staff the utility and executing a contract to design and build the first phase of the project. The approved contract will "provide design, engineering, and construction management services for the implementation of a fiber-to-the-premise network. Hillsboro plans to spend $28 million on the project over the next seven years. The first year of the contract will cost $704,896. An Oregon Telecommunications Association representative spoke before last week's council meeting to express concern about the plan. http://hillsborosignal.com/2018/06/25/city-approves-contract-for-municipal-fiber-rollout/

Portland and Gresham
A proposal is coming before the Portland City Council, for a public-owned internet access provider that would be cheaper than Comcast and 40 times faster and would pay for itself costing taxpayers nothing.

Municipal Broadband PDX is the brainchild of Multnomah County data engineer Michael Hanna, a former president and now chief steward at American Federation of State, County and Municipal Employees (AFSCME) Local 88, the union which represents the employees of Multnomah County.

Hanna's vision is a new public internet utility to provide good service, good prices, and good jobs. IBEW members would install the fiber optic cables, and AFSCME members would administer the network, just as they do in the Portland Water Bureau.

Hanna and the Municipal Broadband PDX campaign are proposing that Portland, Gresham, and other cities in Multnomah County join together to pay for a feasibility study that looks at existing

infrastructure and what it would cost to install fiber to the home in the Portland Metro area. To date, the Multnomah County Commission, and the city councils of Fairview, Gresham, Troutdale, and Wood Village have voted to share the costs of the proposed feasibility study. https://municipalbroadbandpdx.org/

The Portland City Council is expected to hold a hearing on Oct. 30 and vote Nov. 7 on whether to join the other jurisdictions in the feasibility study. If they give the go-ahead, Multnomah County will move forward with the study, and make a decision next year. https://nwlaborpress.org/2018/09/private-monopolies-failed-to-deliver-fiber-now-its-time-for-municipal-broadband/

John Day
State legislators approved $2.25 million in funding for John Day. City Manager Nick Green said $1.82 million will go toward fiber optic broadband service, and $420,000 will go to help fund the local dispatch center. The broadband funding, requested by Sen. Ted Ferrioli, will allow for nearly 70 percent of county residents to access high-speed internet. http://www.bluemountaineagle.com/Local_News/20170725/john-day-receives-225-million-in-state-broadband-dispatch-funding

Eugene
The city of Eugene in an economic development partnership with Eugene Water and Electric Board, Lane Council of Governments, with support from Technology Association of Oregon has launched EUGNET, an open access, publicly owned network. About 70 buildings have signed up to connect to the fiber network. http://eugnet.org/

Maupin
The Maupin Broadband project incorporates multiple phases in order to bring broadband access via a fiber to the premises network to businesses and homes in the city of Maupin and enable additional fixed wireless service in the surrounding area. The project is requesting funding for the construction phase of this effort, to build the locally owned fiber network to each premise in Maupin and install a public wireless system to support downtown economic development. The planning and completed steps are described below as well as the final steps in the project that are currently seeking funding.

Planning: In 2012, planning conducted in Wasco County, by Q-Life in partnership with the Oregon Broadband Advisory Council's Broadband Strategic Planning project, highlighted a focus on adoption of broadband by local businesses and community members as well as access challenges in South Wasco County. In 2014, Q-Life began studying the feasibility of developing a fiber connection in Maupin and initial demand surveys were conducted by Mid-Columbia Economic Development District (MCEDD), the Wasco County Economic Development Commission, and the South Wasco Alliance. Surveys were distributed throughout South Wasco County in early 2015, with support from a grant from Google. Survey results showed that about 70% of respondents said they were not satisfied with their current service; over 90% said they would be interested in new service if it was available. 35% said they were already using the internet to support home-based businesses and 22% said they were telecommuting. More said they would pursue this type of opportunity if they had better/faster service with more reliability

(i.e., true broadband). These responses show the significant economic development opportunity that is created through the building out of a comprehensive community network versus one just focused in the traditional business core of the community.

Engineering and Construction: In late 2015, the state of Oregon through the Regional Solutions program committed a $410,000 grant to bring open-access fiber into Maupin to address this need. Q-Life also entered into an agreement with LS Networks to partner on the project. It was determined that LS Networks would be able to bring fiber access to town from several miles away and build a point-of-presence (POP) where a local access network could tie into a backhaul connection. This was completed with significant private investment by LS Networks. During this build, the local distribution backbone was hung and is awaiting construction of the local distribution network. Along with this construction, Q-Life has finalized engineering and construction drawings to complete the remaining phase of this project.

Final Phase: The last step in this project is to construct the publically owned open access local network in Maupin that will provide fiber to the premise that allows for service levels of up to 1 Gbps initially with additional capacity for growth. However, changes in the construction market since the inception of the project have increased costs significantly. Q-Life has gone out to bid for this project and received extremely high bids for construction that are much larger than the previously anticipated budget. The city of Maupin is contributing additional in-kind work by their Public Work department to place conduit and reduce the underground work required during the final construction phase, but the project partners are still seeking funding. With funding, Q-Life and Maupin can start last-mile construction in the spring of 2018. The Regional Solutions and local investment will only fund a portion of the costs due to changes in the construction market since the project's conception which has driven costs up significantly.
The total project cost is estimated at approximately $1,034,891. The project proponents are seeking approximately $500,000 in additional funding to complete the project. The partners anticipate construction in spring of 2018 with completion by fall of 2018.

Sandy
Fifteen years ago with incumbent providers not providing for the community's needs, the city decided to build its own network. Starting from scratch without an electric utility, the people originally built a citywide Wi-Fi network. In 2014, Sandy began constructing a municipally owned fiber-to-the-premises network, and now has one of the most advanced, affordable gigabit fiber networks in the United States. SandyNet has received national and international recognition including the production of the following video, "Gig City Sandy: Home of the $60 Gig." https://muninetworks.org/content/municipal-ftth-networks#OR

Independence and Monmouth
Monmouth and Independence are two cities about 15 miles southwest of Salem. Together, they have about 20,000 people. Until 2005, their options for internet access were limited to mostly dial-up. That changed when the towns came together under Oregon Revised Statute 190 to establish MINET. It's a FTTH network that is available to every home and business in the two cities. The network offers triple-play: video, phone, and internet services. MINET doesn't use tax dollars, just user fees, because the project was funded through revenue bonds.

Year: 2006
Population: 20,000
Cost: About $27 million
Funding Method: Revenue bonds
Governance: Board of Directors
Services: Internet access, voice, video
Top Residential Speed: 100 Mbps/50 Mbps
MINET's Website: MInetFiber.com
MuniNetworks' Coverage: N/A

Dallas

MINET has entered in to a partnership to build Willamette Valley Fiber, a new fiber-to-the-home network in Dallas. MINET will operate the network. The network should be in service by the end of 2018.

Willamina

A 10 Gig fiber network project is underway in Willamina, with completion scheduled for the end of the year, using the same integrated framework that was pioneered in Dayton. Dayton's school has become a model for school districts around the state for preparing students to be makers and creators in new innovation economy.

Counties

Gilliam County

Gilliam County is working on a middle mile fiber solution to serve the County Seat, Condon. The county has a PSAP in Condon that serves four counties. Inland Communications has just begun construction of fiber from Arlington to Condon. The shared goal of the county and city is to use such fiber to promote the availability of broadband and other advanced telecommunications services to residents and businesses throughout Gilliam County, including those in the city of Condon as well as the geographic sub-region in which the county and city interact. http://www.co.gilliam.or.us/

Grant County

John Day City Manager Nick Green announced that the Grant County Digital Network Coalition is establishing a public-private partnership with Oregon Telephone Corporation, and a plan for phased expansion of broadband internet service south from John Day to Burns. The goal is to have the Grant County Digital Network Coalition own and operate the fiber backbone and have Ortelco be the internet provider to the end user, Green told the council. He wanted the coalition to be in the wholesale business, not the retail market. Much of the plan rests on the coalition being awarded a U.S. Department of Agriculture Community Connect grant worth up to $3 million and requiring a 15 percent match.
http://www.bluemountaineagle.com/Local_News/20180514/ortelco-partnering-with-broadband-coalition

Multnomah County

Multnomah County plans a $300,000 study to evaluate the prospect of building a fiber network to provide residential internet service, which would be the nation's largest municipal broadband

system. It could potentially cost a half-billion dollars. Advocates say the time has come to consider the possibility of public internet service. They point to the essential role online connections play in contemporary life and the repeal of federal net neutrality, which guarded against preferential treatment for certain web services. Opponents are arguing that it's too big an investment given other regional needs.

https://www.oregonlive.com/silicon-forest/index.ssf/2018/06/multnomah_county_eyes_countywi.html

Sherman County

The cities of Sherman County have been coming together with support from the county to explore opportunities to improve broadband access over the past two years. Despite significant middle-mile fiber investment bringing backbone capacity to each of the four cities (Rufus, Wasco, Moro, and Grass Valley) and Biggs Junction over the last several years, this access has not provided the speeds and reliability residents and businesses require for end users. The cities and county believe that this infrastructure is as critical for their communities as traditional infrastructure such as water, sewer, and power.

As a result, the cities and county jointly sought proposals for a build out of a broadband network that will serve all of the homes and businesses in each community. The goal of this RFP was to ensure that there is abundant, affordable broadband throughout the incorporated cities and Biggs Junction in Sherman County now with enough capacity to support robust access moving forward. After reviewing the responses, the cities and county chose to move forward with a proposal from Gorge Networks to build a fiber-to-the-premises network in Rufus, Wasco, Moro, Grass Valley, and Biggs Junction.

The proposal requires investment from GorgeNet as well as public sector investment of approximately $300,000 into a network that will be owned and operated by GorgeNet with requirements around availability and quality of services and rate increases included in the operating agreement. Public investments were made through the Regional Solutions Regional Infrastructure Fund, each of the four cities and Sherman County.

Construction has begun on the network and service will be turned up in Moro and Grass Valley this fall with the other three communities planned for the spring.

Non-Profit Corporations

A Washington-based nonprofit broadband provider, Northwest Open Access Network (NoaNet), is planning to extend a fiber-optic line through Astoria and Warrenton. NoaNet has easement applications with the Department of State Lands and the National Park Service to run fiber-optic cable along existing communications lines crossing under the Old Youngs Bay Bridge and over the Lewis and Clark River. The broadband provider leases cable in Clatsop County from CenturyLink but is looking to expand its fiber-optic network into Oregon and increase reliability, said Chris Walker, the telecommunications director. NoaNet's new cables would mostly utilize PacifiCorp utility poles and an underwater conduit along the Old Youngs Bay Bridge.

http://www.dailyastorian.com/Local_News/20180503/broadband-provider-eyes-astoria-and-warrenton-market

State of Oregon
Rural Broadband Capacity Pilot Program

The Governor approved funding of $500,000 for grant(s) to support broadband planning, engineering, and/or infrastructure deployment projects targeting rural areas lacking adequate broadband access. These are areas that do not have broadband service available at the current FCC designation of 25 million bits per second (Mbps) downstream and 3 Mbps upstream, excluding satellite service.

The program places particular emphasis on investments that assist communities, businesses, or industries in cost-effective projects that impact retention and growth of significant traded sector industries in Oregon. Business Oregon is administering the Rural Broadband Capacity Pilot Program and will provide financial support in the form of grant(s) of up to a cumulative total of $500,000 for projects that will increase the availability and utilization of broadband infrastructure and services. A grant may be used for the following:

- Planning—Projects to organize and engage rural community stakeholders to develop broadband strategic plans for the deployment, adoption and utilization of broadband infrastructure in their respective communities.
- Engineering—Projects that have completed plans, a grant may be used for the design and engineering of broadband infrastructure.
- Infrastructure—Projects that have completed plans and engineering designs, a grant may be used for the construction of broadband infrastructure.
- Matching Funds—Grant may also be used as matching funds to enable recipients to qualify for grants and loans from federal and private foundation funding programs for broadband planning, engineering and infrastructure deployment projects.
-

Oregon cities, counties, ports, tribes, cooperatives, non-profits, and public-private partnerships submitted proposals in February, 2018. There were 25 applications submitted for more than $4.8 million in requested funding. Grants awarded will support broadband planning and infrastructure projects located in Baker, Columbia, Coos, Curry, Douglas, Morrow, Harney, and Tillamook counties. http://www.orinfrastructure.org/Infrastructure-Programs/Telecommunications/Rural-Broadband-Capacity-Program/.

Organization	Grant Offer	Project Name: Brief Description
City of Baker City	$137,000	**Elkhorn View Industrial Park Broadband:** Baker City will deploy a fiber distribution network throughout the 65-acre city-owned industrial park.
City of Boardman	$10,000	**Broadband Strategic Planning:** Boardman will develop a Broadband Strategic Plan for the city.
City of Glendale	$140,000	**City of Glendale:** Glendale will deploy a city-wide fiber-to-the-home (FTTH) and fiber-to-the-business (FTTB) network through a public-private partnership.
Columbia County	$68,300	**Columbia County Broadband Project:** The county will assess its broadband needs, infrastructure, vendor resources, and strategic options including a county-wide fiber ring to provide high-speed internet services to residents, businesses, anchor institutions and emergency services throughout the county.
Coos Curry Electric Coop	$19,700	**Broadband Feasibility Study:** CCEC will conduct a feasibility study for building a broadband network to provide services to rural underserved areas of Coos, Curry, and part of Douglas counties.
Harney County	$75,000	**Harney County Broadband:** The county will develop a Broadband Strategic Plan in collaboration with the cities of Burns and Hines, and the Burns Paiute Tribe.
Tillamook Lightwave	$50,000	**Port area of Garibaldi:** TLW will expand its fiber network in the Port of Garibaldi area to deliver Gigabit services and support economic development.

Rural Broadband Capacity Pilot Program Project Summary

Oregon Fiber Partnership project
To better achieve their public policy and institutional missions, five public entities—Oregon State University, Oregon Health & Science University, the University of Oregon (including NERO), Portland State University, and the state of Oregon (through the Office of the State CIO)—have formed the Oregon Fiber Partnership (OFP) to jointly develop a new statewide network and a shared network services organization.

Through the OFP, the partners intend to meet their shared need for a statewide network with the information-carrying capacity required to use new technologies (the Internet of Things, Big Data, etc.), which generate unprecedented amounts of data and offer the possibility of new insights into research and public policy challenges. The partners also seek to deliver more cost effective, higher capacity network services to their 600+ locations across the state, making it easier for those sites to collaborate, share information, and deliver services to the public in support of their missions.

The OFP project already is well underway. More than 2,300 route-miles of optical fiber cables have been obtained on a long-term basis to serve as the shared, statewide network backbone. Concurrently, the state of Oregon has an active procurement seeking telecommunications

companies to provide network connections between the OFP backbone and local sites. Initial OFP services will be delivered by the summer of 2019.

The Office of the State Chief Information Officer (OSCIO) is a member of the Oregon Fiber partnership formed through an Intergovernmental bilateral agreement between OSCIO and Oregon State University. Other partners with OSU include Oregon Health Sciences University, University of Oregon & Portland State University for the purpose of implementing an open-access core, high-speed, research backbone network connecting research universities at high-speed (100 Gbps) to each other, the state of Oregon, and Washington, California, and Idaho. Government sites on the network will connect at 10 Gbps. The dark fiber was procured from providers through long term indefeasible rights of use leases. Network deployment is expected to take three to five years.
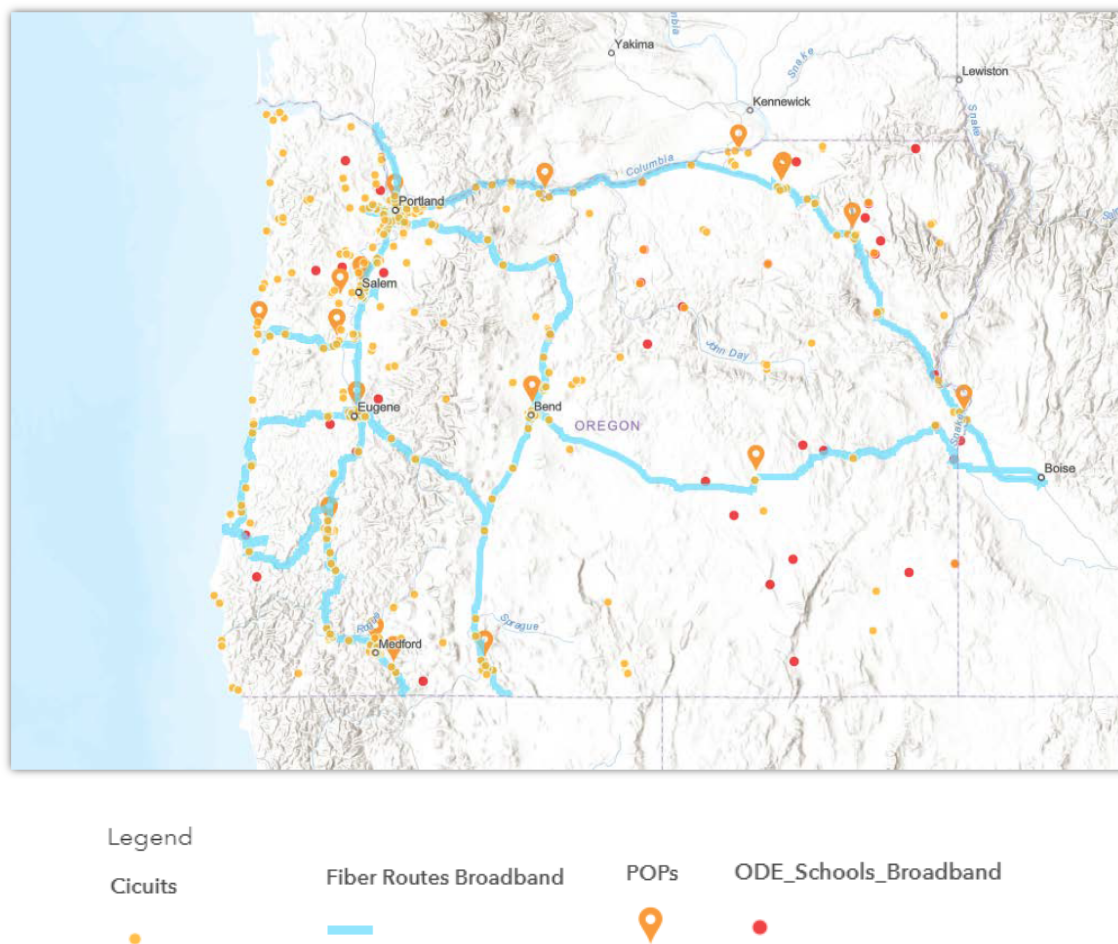
Oregon Fiber Project Map

HB 4023 (2018), now statute, authorizes OSCIO to provide services to selected other non-state agency public bodies and tribes and directs the appointment of a Broadband Services Advisory Committee to assist in drafting the rules for the administration of this authority. Members of the committee represent OBAC, industry, the Association of Oregon Counties, the League of Oregon Cities, public education, public universities, libraries, the State Interoperability

Executive Council, the public, a nonprofit entity with an interest in broadband service availability, and tribes. A first draft of the rules is targeted for June, a second draft in July, a proposed draft in August for presentation to the Joint Legislative Committee on Information Management and Technology in September. The rules are targeted to be approved and to take effect in December 2018– January 2019. It is expected that this authority and process that will stimulate communication and collaboration will help Oregon aggregate demand and better meet needs throughout the state. Initial turn-up of a pilot seventy-mile segment of the Oregon Fiber network is planned for the end of the year in Newport to serve the OSU Hatfield Marine Science Center.

Companies
Telia Carrier
Telia Carrier has established two Points-of-Presence (PoPs) in the Portland area, bringing. Telia's new PoP locations include Hillsboro, a key connection point for sea cable landings coming from the west as well as international traffic from Asia. Telia's expansion to the Portland area gives (OTT) providers, hyper scale cloud networks and carriers the ability to directly connect in market rather than backhauling traffic to other regions, which adds latency. The Portland metropolitan area has become a hub for carriers and content providers as well as regional education and city networks connecting to greater Portland and Eastern Oregon. Telia Carrier's global fiber backbone has grown organically, without acquisitions, and was the first to be 100G-enabled in both Europe and North America. It is also the first network to successfully transmit 1 Tb/s in super channels on its US network.
http://www.pipelinepub.com/news/telia-carrier-expands-to-portland-oregon

Wave
Wave Broadband completed a 97-mile underground fiber line between its network of data centers in the Portland suburb of Hillsboro, Ore. and the Oregon Coast, speeding up data and increasing reliability for its customers while connecting them with top Asian markets.

The Nestucca Route connects the data centers with an undersea cable landing station in Pacific City, Oregon, for undersea cables that traverse the Pacific Ocean. With this new underground line, Wave customers are now directly linked to markets in China, Taiwan, South Korea, and Japan via the landing station, with more to come as a new cable scheduled to come online in October is completed. Underserved communities along the coast will be boosted by the fast, reliable connections to data centers in Hillsboro created by the new line.

"The completion of the Nestucca Route is not only a major milestone for our company, but it, along with the 101-mile Salmon Route, represents a truly unique solution for the submarine cables that land in Oregon," said Greg Palser, Wave VP of Business Development. "These two fiber routes make up the only low-latency submarine cable backhaul constructed on the West Coast in the last 10 years. The Nestucca and Salmon routes will also provide businesses with crucial redundancy in case of route disruption or repair."

Wave said several West Coast government, finance, and hospitality-based businesses are already taking advantage of the completed fiber route. Wave pointed to the Seattle-based National

Science Foundation's Ocean Observatories Initiative as an example of a prominent user. The organization uses Wave's fiber infrastructure to transmit high volumes of ocean monitoring data and commands related to earthquake detection and underwater volcanism to researchers and educators across the globe using cabled instruments.

Kirkland, Wash.-based Wave has been steadily building out its fiber infrastructure for years, and the company says it has 7,500 miles of fiber lines along the West Coast in Washington, Oregon, and California. http://gearsofbiz.com/wave-broadband-completes-underground-oregon-fiber-line-providing-a-gateway-to-top-asian-markets/93357

http://www.fiercetelecom.com/telecom/wave-completes-oregon-coast-underground-fiber-route-links-undersea-cable-landing-station

Fortunately for Oregon, there is a great deal of interest and activity in the deployment, adoption and utilization of broadband. Though a good representation of projects and initiatives has been presented, there are many other projects and initiatives that have not been captured.

Broadband Public Policy

Oregon has recognized telecommunications as essential infrastructure for many years and has an established broadband public policy in statute and resolution.

- …it is the goal of this state to promote access to broadband services for all to improve the economy, improve the quality of life in communities and reduce the economic gap between Oregon communities that have access to broadband digital applications and services and those that do not… [ORS 759.016(1)]
- "It is the policy of the state to promote, facilitate and encourage activities, projects and businesses that improve Oregon's Internet Protocol (or IP) network infrastructure, performance and connectivity to the internet backbone network for the benefit of Oregon's users." (SJR 19 (2007))
- "It is the policy of the state to encourage and support the rapid deployment of broadband telecommunications services in areas of the state to ensure homeland security protections and to ensure emergency communications and public safety." [ORS 401.706]
- It is the policy of the state to promote and facilitate activities by Oregon's health care and education communities and their telecommunications providers to develop standards for interoperability, establish peering for health care and education telecommunications in Oregon." (SJR 20 (2007))

Oregon's broadband public policy needs to be focused on the future, be more aggressive, be more financially supportive, be more specific, and have a renewed sense of urgency.

There have been an increasing number of broadband legislative concepts introduced in the Oregon Legislative Assembly in recent sessions.

2017 Legislative Session—Broadband related bills signed into law
HB 2091
Authorizes Public Utility Commission to use universal service fund moneys to encourage broadband service availability and to provide support to telecommunications carriers that provide both basic telephone service and broadband service. Deletes obsolete language. Becomes operative July 1, 2017. Declares emergency, effective on passage. Presession filed at the request of House Interim Committee on Rural Communities, Land Use and Water. Status: Passed by the Governor signed into law 5/15.
https://olis.leg.state.or.us/liz/2017R1/Downloads/MeasureDocument/HB2091/Enrolled

HB 3213
Expands contents of report by Oregon Broadband Advisory Council to Joint Legislative Committee on Information Management and Technology to include role of broadband technology in local, state and regional economies and economic development. Status: Governor signed into law 5/23/17.
https://olis.leg.state.or.us/liz/2017R1/Downloads/MeasureDocument/HB3213/Enrolled

SB 90
Transfers information technology security functions of certain state agencies in executive branch to State Chief Information Officer. Establishes Oregon Cybersecurity Center of Excellence in

office of State Chief Information Officer. Establishes Oregon Cybersecurity Fund. Continuously appropriates moneys in fund to office of State Chief Information Officer for operation of Oregon Cybersecurity Center of Excellence and for certain initiatives. Declares emergency, effective on passage. By order of the President of the Senate in conformance with presession filing rules, indicating neither advocacy nor opposition on the part of the President (at the request of Governor Kate Brown for Oregon Department of Administrative Services). Status Governor signed into law.
https://olis.leg.state.or.us/liz/2017R1/Downloads/MeasureDocument/SB90/B-Engrossed

SB 786
Requires Oregon Board of Dentistry to allow dental care provider to use telehealth when dental care provider determines telehealth is appropriate. Requires board to treat provision of dental care service in same manner regardless of method of delivery of dental care service. Status: Governor signed into law 6/15.
https://olis.leg.state.or.us/liz/2017R1/Downloads/MeasureDocument/SB786/Enrolled

2018 Legislative Session—Broadband related bills signed into law
HB 4023
Directs Oregon Broadband Advisory Council to conduct a study to identify options for a local broadband champion program to foster and support local broadband champions. No later than December 1, 2018, the council shall report to the interim legislative committees on economic development with a proposed local broadband champion program structure that identifies potential public or private partnerships and anticipated funding needs and sources. Establishes the Connecting Oregon Schools Fund is established in the State Treasury, separate and distinct from the General Fund for the purpose of providing matching funds for federal moneys received by school districts for the purpose of providing broadband access to eligible schools in this state. Authorizes Office of the State CIO to provide services to selected other non-state agency public bodies and tribes. Directs the State CIO to appoint a Broadband Services Advisory Committee to assist in the administration of this authority. Status: Governor signed into law 4/3.
https://olis.leg.state.or.us/liz/2018R1/Downloads/MeasureDocument/HB4023/Enrolled

HB 4155
Relating to internet service providers; and declaring an emergency. Provides that a public body may not contract with a broadband internet access service provider that does not adhere to the principles of network neutrality as specified in the Bill. Status: Governor signed into law 4/9.
https://olis.leg.state.or.us/liz/2018R1/Downloads/MeasureDocument/HB4155/Enrolled

Net Neutrality
Net Neutrality remains a controversial issue. The FCC rescinded its Net Neutrality rules despite significant public and congressional objections. In response, many states including Oregon have sought to re-establish provisions for network neutrality.

The Oregon Public Utility Commission has initiated a proceeding—Docket AR 618—to develop rules implementing Oregon's new "net neutrality" law, HB 4155.

Under the new law, the Commission must, among other things, determine what public disclosures regarding network management practices and performance broadband service

providers will be required to make when providing broadband internet access to "a public body." The Commission must also establish how to ensure that providers are meeting other statutory obligations for providing broadband internet access.

PUC Staff expect to propose rules by the end of summer to enable the commission to issue a formal notice of proposed rulemaking in time to meet the statutory timeline. The formal stage of the rulemaking process should conclude by the end of 2018, with updated rules going into effect by January 1, 2019 when the law becomes effective.

In October 2018, California Governor Jerry Brown approved the nation's strongest net neutrality law in response to the FCC's action. The California law would stop internet providers from favoring certain content or websites and may provide a model for the U.S. Congress or other states to re-establish net neutrality rules. The U.S. Department of Justice moved to stop the law from taking effect, arguing that it creates burdensome, anti-consumer requirements that go against the federal government's approach to deregulating the internet.
https://www.oregonlive.com/business/index.ssf/2018/10/new_california_net_neutrality.html

The Net neutrality issue is multi-faceted. The pro and con positions are not necessarily mutually exclusive. A model that addresses the economic concerns for equitable compensation of the carriers, and the equal access concerns of content providers and end users needs to be developed.

Ray Baum's Act:
The Repack Airwaves Yielding Better Access for Users of Modern Services Act, or RAY BAUM'S Act is named for the former House Energy and Commerce Committee Staff Director, former Oregon Public Utility Commission Chair, former Oregon State Representative, former Oregon Broadband Advisory Council Chair and long-time friend of U.S. Congressman Greg Walden, who lost his battle with cancer earlier this year.

Ray Baum is a former Oregon legislator and utility commissioner.
Courtesy of Rep. Greg Walden's Office

Ray Baum, former Oregon State Representative, House Majority Leader, Chair
of the Oregon Public Utility Commission and Chair of the Oregon Broadband
Advisory Council

This bill, which is the result of a bipartisan, bicameral agreement among House and Senate leaders, passed the U.S. House by voice vote on March 6, 2018.

The bill reauthorizes the FCC for the first time since 1990 and includes reforms to ensure the commission continues to improve its efficiency and transparency, while also making improvements to services for rural residents, veterans, Native Americans, and public safety.

It includes the critical spectrum auction deposit "fix" which allows the FCC to deposit upfront payments from spectrum bidders directly with the U.S. Treasury, enabling future auctions to take place.

Enacts key provisions from the Senate-approved MOBILE NOW Act (S. 19) to boost the development of next-generation 5G wireless broadband by identifying more spectrum—both licensed and unlicensed—for private sector use and reducing the red tape associated with building wireless networks. https://energycommerce.house.gov/news/press-release/chairman-walden-house-passage-omnibus-bill/

On September 26, 2018, the FCC released a Notice of Proposed Rulemaking proposing rules to implement Ray Baum's Act.

Rural Broadband Office Bill
U.S. Senate Bill 2959 (S 2959), sponsored by Sens. John Hoeven (R., N.D.) and Amy Klobuchar (D., Minn.), has been introduced proposing to establish an Office of Rural Broadband. "Under the legislation, the Office of Rural Broadband will coordinate with the U.S. Department of Agriculture (USDA), the National Telecommunications and Information Administration (NTIA), the Universal Service Administration Company (USAC) and other agencies to ensure that all federal agencies with jurisdiction over rural broadband work together to maximize federal funding and coordinate efforts to improve and sustain broadband services in rural areas," a news release said. "Additionally, the office will be responsible for tracking broadband adoption rates in rural areas, coordinating federal efforts to remove barriers to broadband deployment, assessing the impact of FCC actions on rural consumers and providing annual reports on progress." https://www.congress.gov/bill/115th-congress/senate-bill/2959/text

U.S. Department of Agriculture (USDA)
In August 2018, USDA launched a new webpage featuring information about the importance of rural e-Connectivity and the ways the U.S. Department of Agriculture (USDA) is investing to help deploy high-speed broadband infrastructure in rural America. USDA Secretary Purdue said that "Rural high-speed broadband e-Connectivity is as important for economic development as rail, roads, bridges and airports—and as vital as the buildouts of rural telephone networks were decades ago, USDA is committed to being a strong partner with rural leaders in deploying this essential infrastructure." Reliable and affordable high-speed internet e-Connectivity acts as a catalyst for rural prosperity by enabling efficient, modern communications between rural

American households, farms, ranches, businesses, schools and health care centers. Yet, according to the Federal Communications Commission, 80 percent of the 24 million Americans who lack broadband access live in rural areas and on tribal lands.
https://www.usda.gov/broadband

It is anticipated that the next Congress will consider proposals for $40 billion in new broadband funding in 2019.

Broadband Accessibility in Oregon

Broadband services are widely available at competitive prices throughout the state through many national, regional, and local service providers.

Broadband Providers in Oregon

The following is a list of facility-based broadband providers that have supplied data for the Oregon Broadband Map. An asterisk before the Provider Name indicates that they are 'business-only' broadband internet service providers.

Provider Name	URL
Allstream	https://allstream.com
Alyrica	http://www.alyrica.net
Applegate Broadband LLC	http://www.applegatebroadband.net/
Ashland Fiber Network	http://www.ashlandfiber.net
AT&T Mobility LLC	http://www.att.com
*Axxis Communications	http://www.axxistel.com
Beaver Creek Telephone Company	http://www.bctelco.com
BendBroadband	http://www.bendbroadband.com
BendTel	http://www.bendtel.com
Blue Mountain Cable Co.	http://www.bmtvcable.com
Cableone	http://www.cableone.net
Cal-Ore Communications Inc.	http://www.cot.net
Canby Telcom (DirectLink)	http://www.directlink.coop
Cascade Networks, Inc. (by Wave)	https://cni.net/
Cavenet	http://www.cavenet.com/
CenturyLink	http://www.centurylink.com
Charter Communications Inc. (Spectrum)	http://www.spectrum.com
City of Cascade-Locks	http://www.cascade-locks.or.us
Clear Creek Mutual Telephone Company	http://www.ccmtc.com
CoastCom, Inc. (by Wave)	http://www.coastcom.net
Cogent Communications Group	http://www.cogentco.com
Coltontel	https://web.colton.com
Comcast	http://www.comcast.com
Communications Access Cooperative Holding Enterprise	http://hrec.coop/services/internet-service
Community Broadband (Yellow Knife Wireless)	http://www.ykwc.com
Comspan Communications Company	http://www.comspancomm.com/en
Cottage Grove WiFi	http://www.cgwifi.net
Country Vision Cable	http://www.countryvisioninternet.com/
Crestview Cable (BendBroadband)	http://www.crestviewcable.net
Cricket Communications, Inc.	http://www.mycricket.com
Datavision Communications	https://www.datavision.coop/
DC Wireless	http://www.dcwisp.net
DirectLink	https://directlink.coop
Douglas FastNet	http://www.dfn.net

|	
Eagle Telephone Systems, Inc.	http://www.eagletelephone.com
*Earthlink, Inc. (Windstream Enterprise)	http://www.windstreamenterprise.com
Eastern Oregon Net, Inc.	http://www.eoni.com
Eastern Oregon Telecom	http://www.eotnet.net
*EasyStreet Online (Atmosera)	http://easystreet.com
Elgin TV Association	http://highspeedinternet.com/providers/elgin-tv-association
Fibersphere	http://fibersphere.net
FireServe	http://www.fireserve.com
*Freewire Broadband LLC	http://www.gofreewire.com
Frontier Communications of Oregon	http://west.frontier.com
FTX Networks LLC	http://wwwftxnetworks.com
Gervais Telephone Company (DataVision Coop)	http://www.datavision.coop
Gorge Networks	http://new.gorge.net
Helix Telephone Company	http://www.helixtel.net
HYAK	https://hyak.co/siuslaw-broadband
HughesNet	http://www.hughesnet.com
Hunter Communications, Inc.	http://www.hunterfiber.com
*Infostructure	http://infostructure.net
*Integra Telecom (Allstream)	http://www.allstream.com
Ispeed Wireless	http://www.ispeedwireless.com
J & N Cable Systems, Inc.	http://www.highspeedinternet.com/providers/j-n-cable-systems
*Level 3 Communications, LLC (CenturyLink)	http://www.level3.com
LS Networks	http://www.lsnetworks.net
M2 MachMedia	http://machmedia.net
Megapath Corporation	http://www.megapath.com
MINET	http://www.minetfiber.com
Molalla Communications Company	http://molalla.net
Monitor Cooperative Telephone Company	http://monitorcoop.com
Monroe Telephone	http://www.monroetel.com/
Mount Angel Telephone Company (DirectLink)	http://www.directlink.coop
Nehalem Telecommunications Inc.	http://www.rtci.net/Oregon.aspx
North-State Telephone Co.	https://new.ortelco.net/northstate/
OneWave Networks (Tekfinity)	http://www.tekfinity.net
OnlineNW	http://www.onlinenw.com
*ORCA Communications	http://www.orcacomm.com
Oregon Telephone Corporation	http://www.ortelco.net
OregonFast.net	http://www.oregonfast.net
Oregon-Idaho Utilities, Inc.	http://www.oiutelecom.net
Outreach Internet	http://www.outreachinternet.com/
PEAK Internet	http://www.peakinternet.com
Pendleton Fiber Company	http://wtechlink.com
Peoples Telephone Company	http://www.sctcweb.com/PTC/index.php
Pine Telephone Systems, Inc.	http://new.ortelco.net/pine/

Pioneer Telephone Cooperative	http://www.pioneer.net
PocketiNet Communications Inc	http://www.pocketinet.com
Prinetime Internet Solutions, LLC	http://www.prinetime.net
QualityLife Intergovernmental Agency	http://www.qlife.net/
*Quantum Communications	http://www.quantum-networks.net/
Reliance Connects	http://www.relianceconnects.com/
Roome Telecommunications Inc.	https://roome.com
Rural Technology Group, LLC	http://www.ruraltechnologygroup.com
Safelink Internet Services	http://www.safelink.net
SandyNet	http://www.ci.sandy.or.us/sandynet
SawNet (Now Wave)	http://www.wavebroadband.com
Scio Mutual Telephone	http://www.smt-net.com
SCS Communications	http://www.sctcweb.com/SCS/index.php
Silver Star Telecom LLC	http://www.silverstartelecom.com
Siuslaw Broadband (HYAK)	https://hyak.co/siuslaw-broadband
Skycasters	http://www.skycasters.com
Snake River PCS	http://www.eagletelephone.com/ services_snakeriverpcs.shtml
Spectrum	https://spectrum.com
SpeedyQuick Networks	http://speedyquick.net
Sprint	http://www.sprint.com
St Paul Telephone	http://www.stpaultel.com/
Stayton Cooperative Telephone Company	http://www.sctcweb.com/SCTC/index.php
Stephouse Networks	http://www.stephouse.net/
TDS Telecom	http://www.tdstelecom.com/
Tekfinity	http://www.tekfinity.net
T-Mobile USA, Inc.	http://www.t-mobile.com
Tnet Broadband	http://tnet.biz/index.php
*TW Telecom of Oregon LLC	http://www.twtelecom.com/
United States Cellular Corporation	http://www.uscellular.com
UnwiredWest LLC (XS Media)	https://xsmedia.com
Upward Access	http://www.upwardaccess.com/
Verizon Wireless	http://www.verizonwireless.com
ViaSat Communications, Inc.	http://www.viasat.com
Windstream Enterprise	https://www.windstreamenterprise.com
Wallowa Valley Networks	http://www.wallowavalley.net
Warm Springs Telecommunications Co.	http://www.warmspringstelecom.com
Wave Broadband	http://www.wavebroadband.com
Webformix Company	http://www.webformix.com/
Whiz To Coho, Inc.	http://whiz.to/
Wtechlink	http://wtechlink.com/
XS Media	https://xsmedia.com
Yellowknife Wireless	http://www.ykwc.com
Zayo Group LLC	http://www.zayo.com

* Serves Business customers only.

This following 2016 map illustrates the number of broadband service providers across the state and shows extensive coverage throughout the state, but as was noted before, broadband is a moving target. The level of accessibility varies with the definition of broadband.
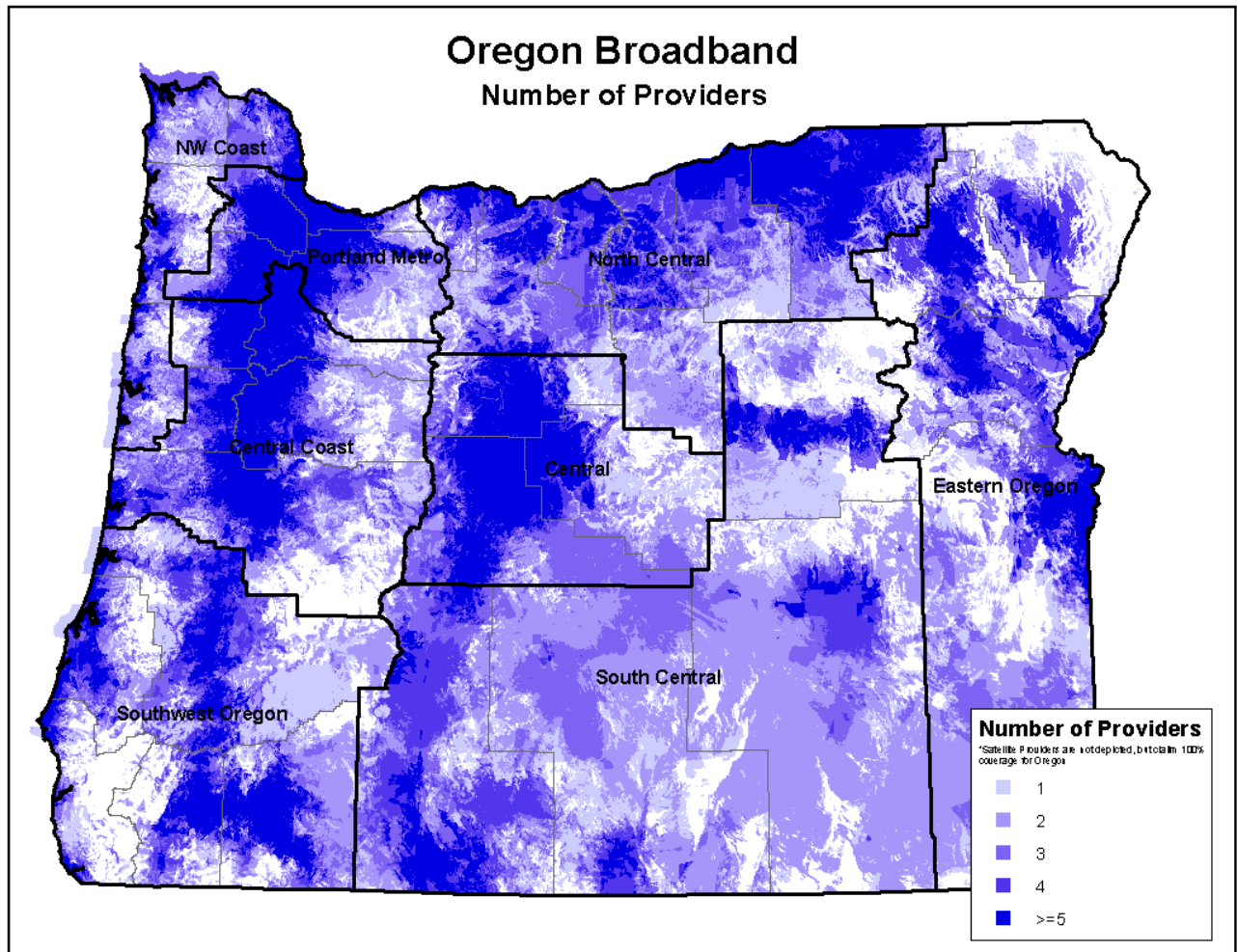
Oregon Broadband Number of Providers 2016

A 2017 map that defines broadband using the current FCC standard of at least 25 Mbps downstream and 3 Mbps upstream produces a different image.
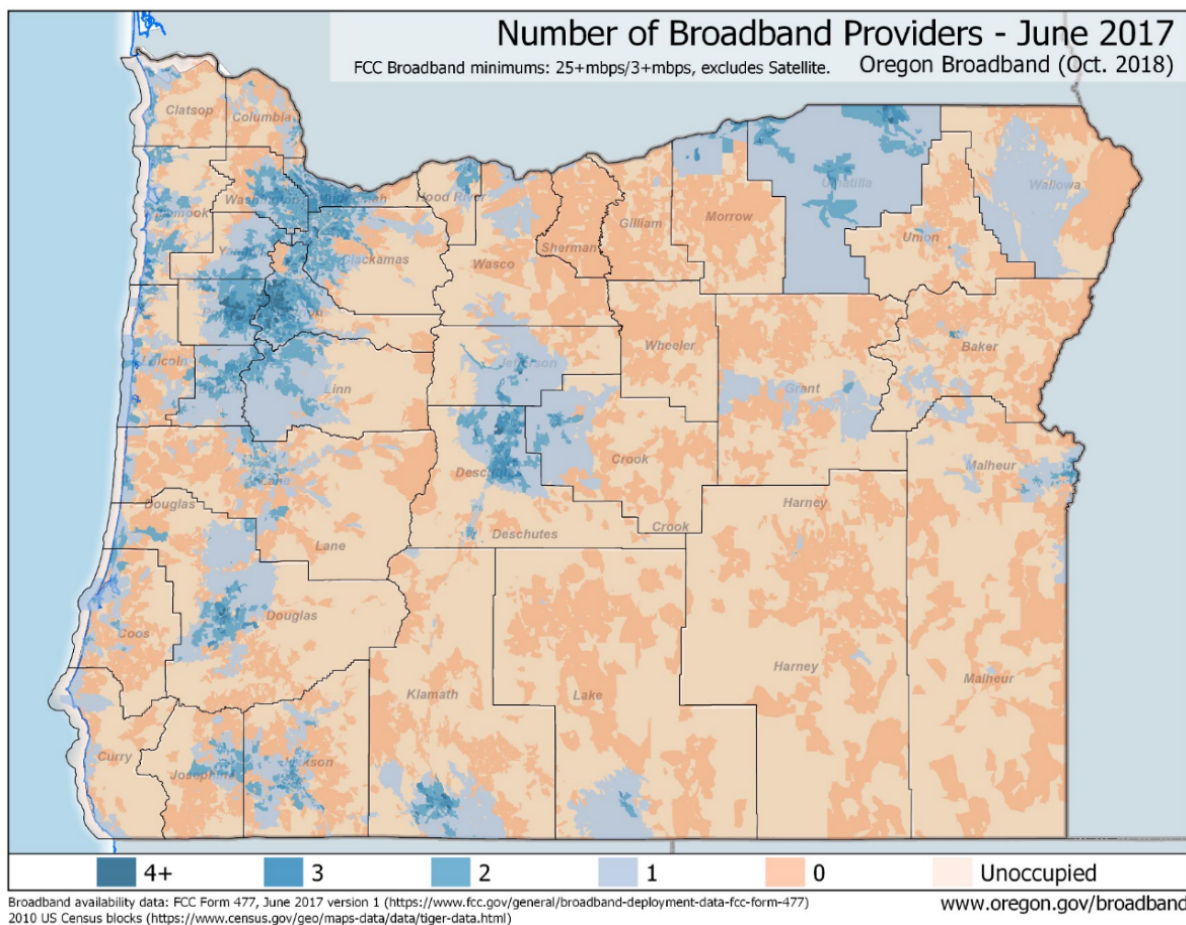
Oregon Broadband Number of Providers 2017
(Broadband = Minimum 25Mbps down and 3 Mbps up)

These maps were produced on the Oregon Broadband Mapping Project website
www.broadband.oregon.gov. Users of the site may produce maps showing service availability,
technology, and providers statewide and by region, county, city, tribal lands, and specific
addresses.

This year's *Broadband Progress Report* concludes that while the United States continues to
make progress in the deployment of broadband infrastructure, it is not being deployed as rapidly
as needed.

Digital Divide
Despite significant progress in deploying broadband infrastructure across the nation, the digital
divide not only continues to exist and is creating economic and community development
challenges. Purdue University released a study on the Digital Divide in March 2018. The study's
findings and recommendations include the following.

Impacts of the Digital Divide
- Job and establishment growth between 2010 and 2015 was substantially lower in counties
  with the highest digital divide; establishments with paid employees declined in counties
  with the highest digital divide while establishments with no employees barely grew.

- Digital economy industries is one of the fastest growing group of industries in the nation—and associated jobs increased overall and across all DDI quartiles between 2010 and 2015.

Policy Recommendations
- Economic and community development efforts need to be refined to target and support digital economy entrepreneurs that are emerging throughout the nation. Robust strategies should not only focus on updating broadband infrastructure, but also on increasing awareness and digital literacy knowledge to effectively leverage and maximize these technologies.
- Collaboration among key local and regional assets—schools, libraries, nonprofits, Extension Services, local economic development organizations, regional planning commissions, think tanks, faith-based among others—should be strengthened. This will ensure that local and regional resources will be working in tandem to tackle the digital divide problem in high need areas of the country.

https://pcrd.purdue.edu/files/media/003-DDI-US.pdf

There was a concern that the emergence of the internet would make public libraries obsolete. It has had the opposite result. Libraries have become essential institutions in providing for digital inclusion. 70% of rural libraries are the only free internet access providers in their community.

The National League of Cities released a report called "Bridging the Urban-Rural Economic Divide," which, among other things, said that in all states, "urban areas outpace their rural counterparts in broadband access." In addition, "states with overall higher levels of broadband access also have more significant urban-rural digital divides, underscoring the importance of extending affordable broadband to rural areas." According to the report, there are no states in which rural areas have more people with access to broadband than urban areas. Overall, rural communities have 37% more residents without broadband access, as compared to urban areas. Alaska has the most significant digital divide, with a gap of 62%, while Massachusetts has the narrowest digital divide, with rural areas having only 8% more people without broadband access than urban areas.

Other states with narrow digital divides include New York, Pennsylvania, and Maryland, while the states with the most significant urban-rural digital divides and most significant lack of high-speed internet access include Wyoming, Alaska, and Oklahoma.

The NLC said the report's findings "echo the call-to-action of NLC's national 'Rebuild With Us' campaign calling for federal-local partnerships to invest in interconnected infrastructure networks—such as broadband—to support a modern economy."
DeLeon, carrie.deleon@wolterskluwer.com
(TR State NewsWire) https://www.nlc.org/

The U.S. Department of Agriculture's Rural Development Innovation Center has introduced an interactive webpage designed to help identify best practices for building rural prosperity.
The webpage https://www.usda.gov/topics/rural/rural-development-innovation-center offers

strategies that have proven effective for creating jobs, building infrastructure, strengthening partnerships and promoting economic growth across the country.
https://cdgportal.com/blog/index.php/2018/04/30/rural-economic-development-best-practices-featured-on-new-usda-rural-development-website/

NTIA Digital Divide Report
The National Telecommunications and Information Administration (NTIA) also issued a report saying that the difference in access between disadvantaged groups and others is closing, according to findings from the recent survey about internet use demographics. The research shows that internet usage increased among American households earning less than $25,000 annually to 62% in 2017, up from 57% two years earlier. Internet usage stayed the same for households earning more than $100,000 annually. Five years ago, only 55% of households earning less than $25,000 annually accessed the internet, compared to 91% of those earning more than $100,000 annually.

According to the survey, 78% of Americans ages 3 and older used the internet as of November 2017, compared with 75% two years earlier. NTIA credits increased internet usage by low-income families, seniors, African Americans, Hispanics, and other groups that had been less likely to go online for the increase. Older consumers are also increasing their use of the internet, NTIA found. About 63% of those 65 and older said they used the internet, compared to only 56% in 2015.

Among the survey's other findings, 64% of Americans used a smartphone in 2017, compared with 53% in 2015. Desktop computer usage dropped to 30% in 2017.

Americans are continuing to increase the number of devices they use. The proportion of people using at least two different types of devices increased to 62 percent in 2017. The use of three or more different device types also increased substantially, from 32 percent in 2013 to 42 percent in 2017. http://www.telecompetitor.com/ntia-report-rising-internet-usage-among-all-demographics-is-closing-the-digital-divide/

Cost to close the urban-rural digital divide with fiber
The cost to deploy fiber to unserved U.S. rural areas is estimated to be about $61 billion by CostQuest Associates, an economic consultancy that specializes in telecom. The estimated cost to deploy fiber to unserved U.S. rural areas is based on deploying Gigabit Passive Optical Network (GPON) fiber-to-the-premises technology and does not include ongoing operational costs.

The main subsidy program on which rural telecom providers rely on today is the $4 billion annual high-cost-to-serve Universal Service Fund which includes the Connect America Fund. With regard to other utilities, many people in rural areas get water and natural gas in a different manner than their urban counterparts—via wells and propane tanks, respectively. And instead of sewers, rural Americans rely largely on septic systems. Rural residents have viable alternatives to the services that people in urban areas receive. For telecommunications, roads and electricity, it is argued that there aren't any ready alternatives available. It is also argued that wind, solar, hydrogen cells, generators and battery technology may eventually provide alternatives for power

with more development, and that fixed wireless and satellite may serve as alternatives for telecom.

https://www.telecompetitor.com/economists-put-the-tab-at-61-billion-to-bring-fiber-broadband-to-rural-u-s/

Broadband Affordability in Oregon

Broadband services are available in Oregon at competitive price points, though prices vary by service area.

A survey of facilities-based broadband service providers serving Oregon customers including broadband transmission rates and monthly service costs follows. Information was collected from service provider websites.

DSL Service Provider	Monthly Rate
Canby Telecom [www.directlink.coop] 5 Mbps upstream, 30 Mbps downstream (faster speeds available)	$49.95
CenturyLink [www.centurylink.com] Up to 20 Mbps downstream (faster speeds including 1Gbps available)	$45.00
Douglas FastNet [www.dfn.net] 1.5 Mbps upstream, 5 Mbps downstream DSL (speeds up to 40 Mbps available)	$39.99
Eagle Telephone System [www.eagletelephone.com] Up to 5 Mbps downstream	$39.99
Eastern Oregon Telecom [eotnet.com] 1 Mbps upstream, 3 Mbps downstream (speeds up to 1 Gbps available)	$29.95
Frontier Communications High Speed Internet [www.frontier.com] Up to 6 Mbps downstream (faster speeds available)	$20.00
Helix Telephone Company [www.helixtel.net] 1 Mbps upstream, 5 Mbps downstream (faster speeds are available)	$32.00
Molalla Communications Company [https://www.molalla.com/] 250 Mbps upstream, 250 Mbps downstream (faster speeds available)	$68.00
Monroe Telephone Company [www.monroetel.com] 1 Mbps upstream, 6 Mbps downstream (faster speeds available)	$34.95
Mt. Angel Telephone [www.directlink.coop] 5 Mbps upstream, 30 Mbps downstream (faster speeds available)	$49.95
Nehalem Telecommunications [www.rtci.net/oregon] 1 Mbps upstream, 5 Mbps downstream (faster speeds available)	$29.95

Oregon Telephone Corporation [www.ortelco.net] $59.95
3 Mbps upstream, 15 Mbps downstream (faster speeds available)

People's Telephone Company [http://ptc-web.com] $39.95
1 Mbps upstream, 10 Mbps downstream
(faster speeds & synchronous service available)

Pine Telephone Company [www.new.ortelco.net/pine] $39.95
1 Mbps upstream, 4 Mbps downstream (faster speeds available)

Pioneer Telephone Company [www.pioneer.net] $44.95
"Power" speed not specified (speeds up to 100 Mbps available)

Scio Mutual Telephone [www.smt-net.com] $60.00
50 Mbps upstream, 50 Mbps downstream (faster speeds available)

St Paul Cooperative Telephone Association [www.stpaultel.com] $39.99
1 Mbps upstream, 3 Mbps downstream (faster speeds available)

Stayton Cooperative Telephone Company [www.sctcweb.com] $39.95
1 Mbps upstream, 10 Mbps downstream
(faster speeds & synchronous service available)

TDS Telecom [www.tdstelecom.com] Prices not posted   Not
512 Kbps upstream, 1. Mbps downstream (faster speeds available)   Posted

Cable Modem Service Provider	Monthly Rate
BendBroadband [www.bendbroadband.com]	$54.99

5 Mbps upstream, 100 Mbps downstream (faster speeds available)

Charter Communications [www.charter.com] $44.99
Starting at 100 Mbps downstream

Comcast [www.comcast.com] $39.99
Up to 60 Mbps (faster speeds available up to Gigabit)

Crestview Cable Communications [www.crestviewcable.com] $27.95
Now BendBroadband
1 Mbps upstream, 5 Mbps downstream (faster speeds available)

Eastern Oregon Telecom [www.eotnet.com] $29.95
1 Mbps upstream, 3 Mbps downstream (speeds up to 100 Mbps available)

Wave Broadband [www.wavebroadband.com] $42.95
1 Mbps upstream, 10 Mbps downstream (faster speeds available)

Mobile Wireless Internet Access (3G / 4G)	Monthly Rate
AT&T Wireless [www.ATTwireless.com] Up to 100 Mbps Mobile Internet access	$50.00
Verizon Wireless [www.verizonwireless.com] 4G LTE Up to 1 GB	$30.00
Sprint [www.sprint.com] 4G LTE Up to 10 GB	$35.00
T-Mobile [www.t-mobile.com] 4G LTE Unlimited talk, text, data	$70.00

Fixed Wireless Internet Access	Monthly Rate
Douglas Fastnet [www.dfn.net] 5 Mbps downstream (speeds up to 15 Mbps downstream available)	$39.99
Eastern Oregon Net, Inc. [www.eoni.com] "High Speed" service	$29.95
Eastern Oregon Telecom [www.eotnet.net] 1 Mbps upstream, 3 Mbps downstream (faster speeds available)	$29.95
FireServe Wireless Broadband [www.fireserve.com] Up to 10 Mbps downstream (faster speeds available)	$39.95
Freewire Broadband [www.freewirebroadband.com] Symmetrical Ethernet. (business)	Prices not posted.
Goose Lake Computing – now Fireserve [www.fireserve.com] Up to 10 Mbps downstream (faster speeds available)	$39.95
GorgeNet [www.gorge.net] 4 Mbps upstream, 30 Mbps downstream (Business) (faster speeds available)	$54.95
Oregon FAST.net [www.oregonfast.net] speeds not specified	$39.99
Rural Technology Group [www.ruraltechnologygroup.com] Speeds not specified	$29.95

Municipal / Consortia / Public-Private Partnership Providers	Monthly Rate
Ashland Fiber Network [www.ashlandfiber.net] 3 Mbps upstream, 60 Mbps downstream (faster speeds available)	$55.00
Eastern Oregon Telecom [www.eotnet.net] 100 Mbps downstream (Gigabit service available)	$79.95
MINET (Monmouth-Independence Network) [www.minetfiber.com] 60 Mbps downstream (Faster speeds available)	$50.00
Q-Life [qlife.net] Q-Life is a middle mile transport provider with independent ISPs providing end-user services. Prices not posted.	Not Posted
SandyNet FTTH [www.sandynet.org] 300 Mbps upstream, 300 Mbps downstream (Symmetrical Gigabit service)	$39.95

Facilities-based Competitive Access Providers

CoastCom by Wave [www.coastcom.net] Internet/Metro Ethernet Services / Prices not posted	Not Posted
Douglas FastNet [www.dfn.net] 100 Mbps downstream, 25 Mbps upstream (speeds up to 1 Gbps downstream, 20 Mbps upstream available via fiber optics)	$39.99

Other Competitive Providers	Monthly Rate
Cogent Communications [www.cogentco.com] DIA, IP Transit, Ethernet, Colocation services	Prices not posted
FTX Networks [ftxnetworks.com] Fiber Optic based services	Prices not posted
Integra Telecom now Allstream [www.allstream.com] / Electric Lightwave [www.electriclightwave.com] Data Networking and Internet, Colocation	Prices not posted
Western Independent Networks [www.win-networks.com] Point-to-Point Special Access/Ethernet Transport/Internet Backbone Access	Prices not posted

Satellite Internet Access	Monthly Rate
HughesNet [www.hughesnet.com] 1 Mbps upstream, 5 Mbps downstream (faster speeds available)	$49.99
ViaSat—WildBlue [www.wildblue.com] 3 Mbps upstream, 10 Mbps downstream (faster speeds available)	$59.99

SkyCasters [www.skycasters.com] $99.00
2 Mbps upstream, 10 Mbps downstream

The Monthly Rates listed above are mostly for base level services. It should be noted that bundled services and ongoing promotional discounted pricing is also widely available from service providers.

Though prices for broadband services in Oregon are competitive with other states, cost continues to be a barrier to adoption for many Oregonians.

Programs for Digital Inclusion

Families and individuals that do not have access to broadband connectivity are at a competitive disadvantage.
- 90% of college applications are now submitted online.
- 79% of teachers assign homework that requires internet access.
- Many large employers only accept job applications submitted online.

Online employment resources now rival personal and professional networks as a top source of job information for Americans who are looking for work. According to Pew Research, less than 18% of households with income below $14,000 have internet Access at home and more than 90% of households with income over $100,000 have internet Access at home.

Many service providers have participated in offering special pricing programs for "digital inclusion" to address the cost barrier for broadband adoption in disadvantaged segments of the population.

Comcast Internet Essentials Program

Comcast Corp. has upgraded its Internet Essentials program, which has provided discounted broadband to 1 million low-income households with more than 4 million residents, according to the company. Upgrades include an increase in Comcast Internet Essentials speed and the addition of out-of-home Wi-Fi. The program is now six years old. Speeds will now increase to 15 Mbps downstream and 2 Mbps upstream, up from 10 Mbps downstream and 1 Mbps upstream, the fourth time in six years that speeds have been increased. The company also is adding 40 hours of free out-of-home WiFi to Internet Essentials (free in-home WiFi already is offered). Additionally, Comcast extended its pilot program for seniors from five metro areas to 12. Internet Essentials costs $9.95 per month plus tax for qualifying households, with an internet-ready computer available for $150. The program has three goals: to reduce digital literacy, improve access to computer equipment and increase affordability. It is a partnership between Comcast and thousands of school districts, libraries, elected officials and community nonprofits, according to Comcast. http://www.telecompetitor.com/comcast-internet-essentials-speed-upgraded-out-of-home-wi-fi-added/

Comcast has announced a comprehensive campaign between Internet Essentials, the nation's largest and most successful high-speed internet adoption initiative for low-income households,

and members of the Conference of Western Attorneys General to address some of the most serious challenges seniors, parents, and children face online. As of August 2017, the Internet Essentials program has connected more than four million low-income Americans in one million households to the internet at home, most for the first time.

The Federal Trade Commission estimates scammers extracted nearly $1 billion from Americans last year alone. More than $240 million of that total occurred either online or via email With the support of a grant from Comcast, the nonprofit Connectsafely.org will develop a multimedia internet safety toolkit for use by Attorneys General across the country. The materials will contain up-to-date materials to meet the specific needs and concerns of seniors, parents with school-aged children, and students. Comcast also will print and distribute copies of these materials and share them on its Internet Essentials Learning Portal, www.InternetEssentials.com/Safety. In addition, Comcast announced it was providing support to several national nonprofits that specialize in internet safety education and research. https://www.businesswire.com/news/home/20180516005976/en

Comcast has announced it has now connected more than six million low-income Americans to the internet through its Internet Essentials program, which is the largest and most comprehensive broadband adoption program for low-income families in the U.S. The company connected more than two million people in the last year alone, which is the largest annual increase in the program's history. The company also announced it will significantly expand eligibility—for the eleventh time in seven years—to low-income veterans, nearly one million of whom live within the Comcast footprint. According to the United States Census Bureau's 2016 American Community Survey, fewer than 70 percent of low-income veterans have internet access, and less than 60 percent own a computer.

"This program has had an enormous impact on millions of families and children who now have high-speed internet at home, many for the first time in their lives," said David L. Cohen, Senior Executive Vice President and Chief Diversity Officer. "We're excited to extend that same opportunity to more than one million, low-income veterans. Veterans have stood up for our country, now it's time for us to stand up for them by providing access to life-changing digital tools and resources."

Since 2011, Comcast has invested more than half a billion dollars to support digital literacy training and awareness, reaching more than 8.5 million low-income Americans. In addition, the company has sold more than 85,000 heavily subsidized computers.

Comcast attributes some of the recent growth of Internet Essentials to its easy-to-use mobile application, which now accounts for more than a third of all enrollments. In addition, the company today released a new seven-year progress report. It contains detailed information about customer demographics and insights, as well as a history of the program's evolution and key milestones. The company has also redesigned its Internet Essentials Learning Center with new content from Common Sense Media and ConnectSafely.org. The site now includes a variety of free videos, tools, and resources that can help individuals learn vital internet safety and digital skills.

AT&T Broadband Access Program for low income users

AT&T offers "Access from AT&T," a low-cost internet service to qualifying households:

- With at least one resident who participates in the U.S. Supplemental Nutrition Assistance Program (SNAP) and
- With an address in AT&T's 21-state service area (Oregon is not included), at which we offer wireline home internet service, and
- Without outstanding debt for AT&T fixed internet service within the last six months or outstanding debt incurred under this program.
- If you are a California resident and at least one member of your household receives Supplemental Security Income (SSI) benefits you also may qualify based on the same requirements that apply to SNAP participants.

Service availability and speed may vary by address. AT&T will assign you the **fastest** of these speed tiers available* where you live:

- 10 megabits per second, for $10 per month**
- 5 megabits per second, for $10 per month
- 3 megabits per second, for $5 per month
- 1.5 megabits per second, for $5 per month
- 768 kilobits per second, for $5 per month

https://www.att.com/shop/internet/access/#!/#%2F

Charter Spectrum

Charter Communications, Inc. announced the launch of its Spectrum Digital Education Grant Program, a philanthropic initiative designed to support nonprofit organizations that educate community members on the benefits of broadband and how to use it to improve their lives. The objective of the Spectrum Digital Education Grant Program is to provide digital education in the communities we serve through financial grants, PSAs, workshops and webinars to local nonprofit organizations. https://newsroom.charter.com/press-releases/charter-communications-launches-1-million-grant-program-to-support-digital-education/

Its Spectrum Internet Assist service is three times faster than comparable industry offerings and is the only low-cost broadband service that meets the FCC's definition of 'high-speed' broadband. Charter's Spectrum Internet Assist is intended to help ensure that K-12 students of eligible low-income families have a chance to get ahead and low-income seniors on Supplemental Security Income can stay engaged in an increasingly digital culture.

Spectrum Internet Assist delivers internet speeds (30 Mbps x 4 Mbps) for a cost of $14.99 per month for qualified customers. Features include a locked-in rate of $5.00 per month for home WiFi, a router and no activation fee. Internet Assist customers are also eligible to receive phone bundle offerings. www.spectruminternetassist.com.

Charter Spectrum notes that it understands how important access to broadband is for all Americans and is working to connect its customers to the online resources and information they

need to be successful in today's digital economy. Charter Spectrum awarded close to $400,000 in digital education grants in 2017 to local non-profit organizations nationwide working to close the digital literacy gap.

BendBroadband

BendBroadband currently offers low-income families low-cost internet access through the "Connect2Compete" program, which provides those families in existing community assistance programs including Family Access Network (FAN), the Boys & Girls Club of Bend, and the Bend Area Habitat for Humanity, with high-speed internet for $9.95 per month. Through Connect2Compete, BendBroadband requires no deposit, no installation or modem rental fees, and guarantees the price for two years. The available speed of service for program participants is 15Mbps download speeds and 3 Mbps upload speeds.

BendBroadband also offers the "Community Partners Program," which provides a mechanism for the Company to support nonprofit organizations with free internet and video services. Selected qualifying organizations will receive an annual service grant. If chosen for the Community Partners Program, BendBroadband will provide one complimentary basic High-Speed Internet connection (plus rental modem) or one complimentary Video subscription with standard converter box and remote control to the nonprofit organization for one calendar year.

CenturyLink

CenturyLink's Internet Basics Program provides 1.5 Mbps internet access to qualifying families for $9.95 (plus tax) per month for twelve months. Qualifying families may also purchase an iPad Minicomputer for $150 plus shipping and handling at initial enrollment and receive free internet training in person or in print. More information is available at http://www.centurylink.com/home/internetbasics/

Frontier Communications

Frontier works in cooperation with government and other discount programs that can help qualified individuals, schools, libraries, community-based organizations, and health care providers meet their needs. Frontier has been authorized to provide E-Rate, Lifeline, Rural Health Care (RHC), and Low-Income Veteran discount programs to approved applicants. The discounts are intended to ensure that qualified entities have access to affordable telecommunications and information services. https://frontier.com/resources/discount-programs

National Digital Inclusion Alliance (NDIA)

NDIA with Public Knowledge and support from Mobile Beacon and Mobile Citizen has published a Discount Internet Guidebook. It is a guide for digital inclusion practitioners—local community-based organizations, libraries, housing authorities, government agencies, and others working directly with community members in need of affordable home broadband service. It describes affordable broadband plans for disadvantaged American households offered by commercial internet providers (or in two cases, nonprofit resellers of a commercial service). This guidebook also contains recommendations for policy makers and internet service providers to improve current offers and establish new offers.
https://www.discounts.digitalinclusion.org/

Broadband Performance

Oregon benefits from over one-hundred facilities-based service providers offering services competitive in performance with services available in other states.
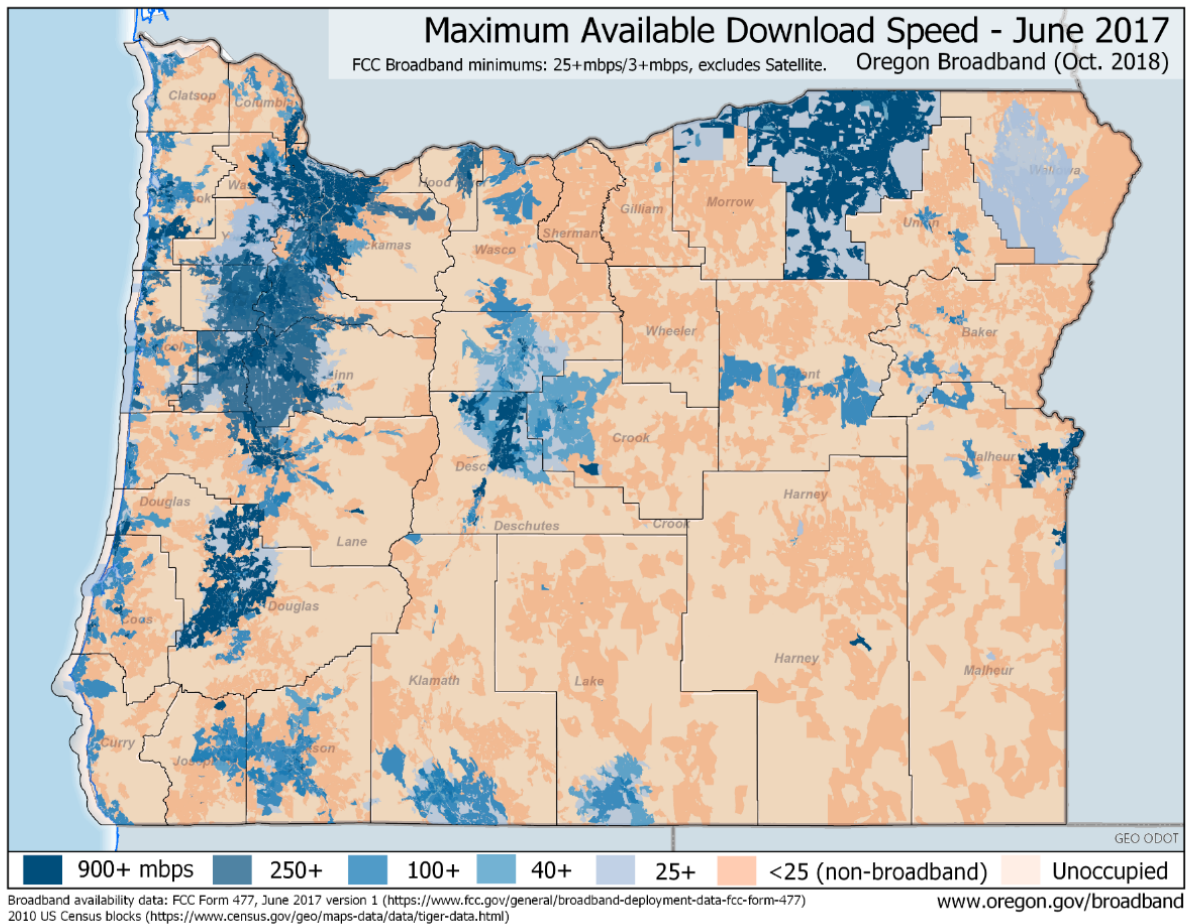
Oregon Broadband Maximum Advertised Speed

The Digital Divide between urban and rural/frontier areas of the state is evident when looking at the distribution of broadband service speeds. This 2017 speed map was produced on the Oregon Broadband Mapping Project website www.broadband.oregon.gov. Users may produce maps showing service availability, technology, and providers statewide and by region, county, city, tribal lands, and for specific addresses.

In a recent study by Cable Co, the United States is lagging behind when it comes to fast broadband. The United States ranks 20th worldwide with an average download speed of 25.86 Mbps. Oregon, however, which ranks in the top ten states in the nation according to Cable Co., would also rank 10th against countries worldwide with an average download speed of 32.16 Mbps.

Broadband Technology Adoption and Utilization

FCC Universal Service Monitoring Report

The FCC released its twentieth Universal Service Monitoring Report on April 13, 2018, prepared by federal and state members of the Federal-State Joint Board on USF. The report is organized into seven sections: section one provides an update on industry revenues, universal service program funding requirements and contribution factors; sections two through five provide the latest data on the low-income, high-cost, schools and libraries, and rural health care support mechanisms; section six presents recent census and Bureau of Labor statistics data on voice telephony subscribership and expenses taken from the Current Population Survey, the American Community Survey and the Consumer Expenditure Survey as well as data on telephone penetration by income by state; and section seven includes updated consumer price index data.

Oregon was reported as having high-speed Internet Penetration for Households of 84.9% compared to national penetration of 81.4% (September 2017 data)
- Internet Penetration for Oregon at 10 Mbps / 1 Mbps = 66% National = 66%
- Internet Penetration for Oregon at 25 Mbps / 3 Mbps = 58% National = 50%
- Internet Penetration for Oregon at 100 Mbps / 10 Mbps = 17%   National = 15%

https://prodnet.www.neca.org/publicationsdocs/wwpdf/041318usf.pdf

Fixed Internet Access Connections by County—FCC

County Name	Consumer (000's)	Non-Consumer (000's)	All (000's)	Households HHS (000's)	Ratio
Baker County	4	1	5	7.16	0.63
Benton County	30	2	33	33.84	0.89
Clackamas County	131	11	142	149.522	0.88
Clatsop County	15	2	16	15.726	0.93
Columbia County	15	1	16	18.785	0.79
Coos County	20	2	22	25.888	0.79
Crook County	6	0	7	9.079	0.72
Curry County	8	1	9	10.454	0.81
Deschutes County	65	6	70	66.337	0.97
Douglas County	32	3	35	43.798	0.74
Gilliam County	1	0	1	0.833	0.67
Grant County	2	0	3	3.149	0.7
Harney County	2	0	2	3.038	0.62
Hood River County	7	1	9	8.189	0.91
Jackson County	65	7	72	83.487	0.78
Jefferson County	6	0	6	7.692	0.75
Josephine County	25	2	27	34.527	0.71
Klamath County	19	2	21	27.188	0.71
Lake County	2	0	2	3.526	0.52
Lane County	118	10	129	146.235	0.81
Lincoln County	20	2	22	20.566	0.95

Linn County	36	3	39	45.1	0.8
Malheur County	6	1	7	10.286	0.63
Marion County	92	8	100	113.996	0.81
Morrow County	3	0	3	3.772	0.69
Multnomah County	267	30	297	310.669	0.86
Polk County	24	2	25	28.458	0.84
Sherman County	0	0	1	0.804	0.56
Tillamook County	11	1	12	10.094	1.08
Umatilla County	16	2	18	26.794	0.61
Union County	7	1	8	10.13	0.69
Wallowa County	2	0	2	3.082	0.69
Wasco County	7	1	8	9.704	0.75
Washington County	182	15	197	206.426	0.88
Wheeler County	0	0	0	0.671	0.51
Yamhill County	30	2	32	34.425	0.87

https://www.fcc.gov/general/form-477-county-data-internet-access-services

Nearly 500,000 new broadband internet subscribers joined the rolls of the largest U.S. cable and telephone providers in the second quarter of 2018, according to new research from Leichtman Research Group, Inc. (LRG).

In the same period last year there was a net gain of 235,000 subscribers. According to the LRG report, the top broadband providers now represent 95% of the market, with the top cable companies having 62.9 million broadband subscribers, and top telephone companies growing to 34.2 million subscribers.
- The top cable companies added about 585,000 subscribers in the second quarter of the year—compared to about 465,000 net new subscribers in the second quarter of 2017.
- Cable company gains were telephone company losses. The telcos had a net loss of 130,000 broadband subscribers in the second quarter. However, that figure was far better than the 230,000 subscribers lost in the second quarter a year ago. Telcos have had net broadband losses in each of the past nine quarters
- Over the past year, broadband providers added nearly 2.2 million net new subscribers, less than the 2.5 million added during the same period a year ago.

https://www.telecompetitor.com/report-nearly-500k-added-broadband-in-2q18-almost-double-from-the-same-period-last-year/

Telehealth
Telehealth, the delivery of health care remotely using advances in various telecommunication technologies (i.e. video-conferencing equipment), is an evolving model for care delivery that increases access, improve outcomes, and reduces costs. By improving access, both geographically and temporally, telemedicine is a transformative use of technology. For acute, life-threatening situations, telemedicine allows earlier involvement of specialists in areas where they are not otherwise physically available. Other in-person health interactions such as routine ambulatory visits with specialists are not urgent, but often do not occur impeded by the current

delivery system. Via telemedicine, access to medically underserved areas, both rural and urban, is improved with resultant improved outcomes, cost savings from reduced patient transports, and high levels of patient satisfaction. Another telehealth area that is expected to grow significantly in the next years is Remote Patient Monitoring, which allows those with chronic diseases to continue to live safely and independently while being followed by specialists in a routine, proactive manner via connected technologies. The term Telehealth is used to broadly include all use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, and public health administration.

Telehealth services are growing beyond the "pilot" or demonstration phases and are increasingly seen as part of the solution to the current healthcare access, outcomes, and financing issues. That said, challenges remain on many fronts ranging from adoption to regulatory. From a broadband standpoint, high-speed access remains a significant barrier to those in underserved areas. A weighty consideration for many that desire to live in rural areas is access to healthcare, especially so for those of retirement age. Access can be greatly augmented with telehealth but it is dependent on the availability of high-speed broadband. And it not just the elderly that face this dilemma, indeed any with an acute or chronic health care need can be better served with this technologically empowered care delivery model.

Oregon is viewed as a leader in Telehealth due to progressive programs employed by many of its healthcare service providers and a supportive state-level public policy. Telemedicine activities in the state have been detailed in previous versions of this report in 2010, 2012, 2014, and 2016. Current clinical activity continues to grow among all the major health systems. In this report, we will report on utilization trends, new significant policy issues, and the continuing challenges affecting Telehealth.

Telemedicine Benefits
Regence BlueCross BlueShield of Oregon released new data in May 2018 showing consumers, on average, save $100 per visit when using telehealth rather than in-person office, urgent care or emergency room visits. Data are based on services provided through national telehealth vendors in Idaho, Oregon, Utah, and the state of Washington, and reflect cost savings associated with medical claims, mileage and wait times in traffic and in the waiting room. Regence estimated telehealth consumers can avoid expenditures in mileage and time spent traveling and waiting for care at about $25 per telehealth visit for median-income earners and upwards of $40 for higher wage-earners. Regence serves more than 2.4 million members in Oregon, Washington, Idaho, and Utah. http://www.newmediawire.com/news/regence-data-measures-real-world-savings-for-telehealth-users-4822238

Telemedicine adoption
The vast majority of adults age 40 or older are comfortable with the idea of using telehealth services for themselves or an older family member, finds a poll from The Associated Press-NORC at the University of Chicago Center for Public Affairs Research (formerly the National Opinion Research Center). Results from the 2018 Long-Term Care Trend poll are important in the context of the "graying of America" and acceptance of technologic solutions. The poll also revealed important and expected caveats: Health care quality must be equal to that of in-person

visits and data must remain private. Also, new terminologies are emerging. The term "virtual care" is becoming more widely used in place of telehealth and telemedicine. Miles Ellenby noted that in Oregon, patients have long been open to "virtual care" through telemedicine and that in many circumstances it's the service providers that have been the greater barrier to adoption, often times due to legislative, regulatory and reimbursement issues.
https://www.longtermcarepoll.org/wp-content/uploads/2018/05/APNORC_LTC_Trend_2018_report.pdf

Policy Developments
Telehealth policy in Oregon has evolved over the past 20 odd years. Both stakeholder engagement with state agencies and direct legislative action have alleviated regulatory constraints in recognition of the technologic progress that has allowed for the variety of new telehealth delivery modalities. Examples of collaboration between providers and state agencies include:
- Grande Ronde Hospital worked with the Oregon Medical Board to change their cross-state licensure protocol allowing Grande Ronde to more easily use out of state consultants to provide needed services.
- The Telehealth Alliance of Oregon collaborated with the state Medicaid office to develop Oregon's first protocols regarding Medicaid payment for Telehealth services.

Telehealth policy in Oregon has also been developed through legislation. Significant legislation has included:
- 1999—Senate Bill (SB) 622: The bill allowed US West to build six interconnected broadband rings throughout the state with funds that would have been used to pay a significant fine from the Public Utility Commission. These rings were to be used by education and healthcare.
- 2003—House Joint Resolution (HJR) 4. The bill expressed legislative support and encouragement for telemedicine and for reimbursement for services delivered "telemedically."
- 2009—SB 24: The bill mandated that health benefit plans cover telemedicine services between health care organizations without consideration for urban and rural designations.
- 2013—SB 569: The bill required the Oregon Health Authority (OHA) to develop uniform documentation requirements for credentialing providers of telemedicine services.
- 2015—SB 144: The bill modified requirements for health benefit plan coverage of "telemedical" health service. It updated Oregon's statute on the reimbursement of clinical services provided through telemedicine beginning in 2017. The bill modified health benefit plan coverage to include coverage of direct provider to patient services via telemedicine regardless of where the patient was located. It also required the Oregon Educators Benefit Board (OEBB) and the Public Employees Benefit Board (PEBB) to cover telemedicine services.
- 2016—SB 5701: The bill appropriated moneys from General Fund to Emergency Board for allocations during biennium. The Bill included $1.1 million for telemedicine services to rural areas through a virtual clinic, increasing opportunities for rural residents to receive care through online video conferencing.

Since the last OBAC legislative report, new legislation and administrative rules related to Telehealth are detailed below:

- 2017—House Bill (HB) 3261: This bill establishes information collection requirements for the Authority to collect in the Financial Incentive Program, which is intended to recruit providers to practice in rural and medically underserved areas. One of the reporting requirements would be to track the percentage of services provided through telemedicine.
- 2017—SB 786: Allows dental care providers to use telehealth if they determine it is appropriate and within their scope of practice. The Oregon Board of Dentistry is required to treat services delivered through telehealth the same as it would those delivered in person.
- 2016—At the request of the Coordinated Care Organizations (CCOs) behavioral health directors, the Oregon Health Authority (OHA) prepared guidance about coverage and reimbursement of behavioral health telemedicine services. As outlined in Oregon Administrative Rule (OAR) 410-120-0250, CCOs are responsible for developing the policies for providers to follow when seeking reimbursement for telemedicine services covered by the Oregon Health Plan.

A significant legislative advance at the federal level occurred during the past year. The CHRONIC Care Act (Creating High-Quality Results and Outcomes Necessary to Improve Chronic Care Act) of 2017 passed the Senate by a unanimous vote. Key components of the act were included in the two-year budget deal that was signed into law in February 2018. Targeted at Medicare's telehealth and telemedicine reimbursement rules, the new law:

- eliminates geographic restrictions on telestroke consultation services, beginning in 2019;
- expands telehealth coverage under Medicare Advantage Plan B, beginning in 2020;
- gives Accountable Care Organizations more flexibility to use telehealth services;
- adds the patient's home freestanding dialysis facilities, without geographic restriction, to the list of originating sites for monthly telehealth assessments with a nephrologist, beginning in 2019, though Medicare would not provide a separate originating site payment if the service was conducted at home; and
- extends for two years the Centers for Medicare & Medicaid Services' Independence at Home demonstration, which establishes home-based primary care teams for Medicare beneficiaries with multiple chronic conditions and increase the cap on the total number of participating beneficiaries from 10,000 to 15,000.

"Tucked into the bill signed are the most significant changes ever made to Medicare law to use Telehealth," said Hawaii Senator Brian Schatz, a key supporter. "It will increase access and quality of care, and reduce costs using tech that's already available."

Another significant telemedicine barrier was eliminated with the recent passage of House Resolution 6, the SUPPORT for Patients and Communities Act sponsored by Oregon Representative Greg Walden. The act requires the Drug Enforcement Administration (DEA) to activate a special registration allowing physicians and nurse practitioners to prescribe controlled substances via telemedicine without an in-person exam. The DEA has no more than one year to complete the task.

An excellent resource for current state laws and reimbursement policies, as well as legislation and regulation tracking can be found on the Center for Connected Health Policy website at https://www.cchpca.org/

OCHIN

OCHIN (originally the Oregon Community Health Information Network) was founded in 2000. A Portland based non-profit, OCHIN is one of the largest and most successful health information and innovation networks, serving more than 500 organizations and 10,000 clinicians across the nation with solutions that improve health care delivery and integration. OCHIN started with a commitment to deliver health information technology services and continues to share insights and provide a growing community the innovative tools, research, knowledge, and voice needed to participate in the national health care landscape. OCHIN is the nation's largest provider of EPIC electronic health records (EHR) systems to Federally Qualified Health Centers. OCHIN also provides data aggregation, disaster recovery, billing, and consulting services.

Since the latest OBAC legislative report, OCHIN has enhanced its telehealth and broadband network offering through the acquisition of the California Telehealth Network and added a NextGen offering (an EHR platform) by integrating two health IT services companies, Voxent and PTSO of Washington into OCHIN.

OCHIN merged with the California Telehealth Network (CTN) in 2017. To improve access to quality care in rural and medically underserved areas, OCHIN and CTN help hundreds of clinics and hospitals connect to high-speed medical grade broadband networks with subsidy funding from the Healthcare Connect Fund (HCF). This Federal Communications Commission (FCC) program dedicates just over $500 million annually to the expansion of access by health care providers to robust broadband networks

Specific to Oregon, OCHIN currently manages the Healthcare Connect Fund Program for over 250 member site locations throughout the state. Current funding for Oregon members exceeds $5.5 million annually, which assists in subsidizing the recurring monthly support necessary for broadband connectivity. OCHIN also supports the broadband infrastructure needs of the most rural and remote health care provider facilities throughout the state. Most recently, OCHIN worked to secure $1 million in support for community health centers and school-based health centers located in rural communities like Butte Falls and Prospect.

OCHIN continues to advocate nationally for expansion of HCF funding to support more clinics in communities of need across the country. OCHIN partnered with fellow stakeholders to engage the FCC on the importance of the program. In 2018, the FCC increased the annual program funding cap by more than $100 million over past years in response to advocacy efforts and the continued popularity of the program.

Additionally, OCHIN's practice-based research network is a unique community laboratory, linking together EHR data from more than 400 community health center clinics across multiple states. Priority areas include:

- Health Systems—focuses on the way care is organized, reimbursed, and measured in health centers to ensure health care systems and metrics reflect the complexity of the patients they serve.
- Social Determinants of Health—evaluates how to capture social determinants—factors in everyday life that impact our health—to improve care for disadvantaged patients.
- Practice Transformation—dedicated to improving health care delivery and outcomes through the development, application, and modification of EHR tools to support evidence-based care.
- Health Policy—examines the effects of federal and state policies on health care access, delivery, and outcomes in order to inform future policy and improve health in our communities.

An example of the important research empowered by the OCHIN network is the recently announced Study on Opioids and the Safety Net Population. The project partners the OHSU Department of Family Medicine and OCHIN on a ground-breaking five-year National Institutes of Drug Abuse (NIDA) funded study examining opioid prescribing in community health centers. Opioid abuse and dependency is ravaging individuals, families and communities in the United States. The purpose of the study is to understand factors associated with problematic use of opioid pain prescriptions in the OCHIN collaborative of community health centers. In addition to information contained within the EHRs, community level information (such as poverty, population health characteristics) will be linked using geographic information system-matched data. More information about OCHIN may be found at www.ochin.org.

Oregon ECHO Network

Project ECHO is a tele-mentoring program that builds the capacity of primary care clinicians to manage conditions that they typically refer to specialty care. Using videoconferencing, a team of specialists (a "Hub") connect to clinicians at participating facilities. Its focus is on providing education and capacity building for service providers, not on providing direct clinical care to patients.

Programs include psychiatry, hepatitis C and liver care, clinical tobacco cessation, and pain and opioids. Programs under development include addiction care, dementia and geriatric care.

Videoconferencing is used to provide services. All programs are offered for no cost to the participant or facility. The Oregon ECHO Network is a statewide utility that supports the delivery of ECHO programming and services and is housed at Oregon Health and Science University. More information about the Oregon ECHO Network may be found at https://www.oregonechonetwork.org/.

Telehealth Alliance of Oregon (TAO)

TAO is a non-profit membership organization that promotes the use of telehealth applications to support access to affordable quality healthcare for all Oregonians, and seeks to advance

telehealth knowledge, practice and policy in Oregon. Membership is open to anyone interested in supporting the mission and goals of the organization. TAO welcomes telehealth service providers, organizations interested in providing telehealth services, suppliers of equipment, software or transport for telehealth services, healthcare insurance providers or anyone interested in improving healthcare through telecommunications. TAO was incorporated in 2005 and is governed by a 15-member volunteer board. More information about TAO may be found at www.ortelehealth.org.

Energy Management

Broadband is helping Oregon utilities move to a smarter electrical grid where power outages are identified, responded to, and repaired more quickly. Additionally, customers are empowered with information to help them understand and manage their energy use, stay connected to their utility in case of emergencies, and use less energy. Saving energy is easier and in some cases automatic as timing of energy use is being managed to match supply.

Advanced Metering Infrastructure (AMI) is an integrated system of smart utility meters, communication networks, and data management systems that enables two-way communication between utilities and customers. Smart meters are electronic devices that record consumption of electric energy in intervals of an hour or less and communicate that information back to the utility for monitoring and billing purposes. Smart meters enable two-way communication between the meter and the central system. In 2012, 55 percent of the electric meters in Oregon were smart meters, but this penetration is increasing with PacifiCorp's recent deployment of AMI in Oregon. Full deployment of PacifiCorp's smart meters should be complete by 2020.

Smart meters can be thought of as one step to modernizing all aspects of the electric grid, from the generation of electricity to the consumption of electricity. The requirements for the speed of such communications are encompassed by broadband. The Federal Communications Commission (FCC) has recognized this and holds that broadband is an advantageous component of smart grids as it allows more content to be carried through information networks. (FCC's National Broadband Plan is available at https://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf).

Smart grids are therefore a noteworthy element of broadband usage in energy management. The three Oregon investor-owned utilities (IOUs) have or will have implemented smart grid infrastructure to achieve higher efficiency in energy management. Most Customer Owned Utilities (COUs) have or will have similar smart grid infrastructures to achieve higher efficiency in energy management as well.

Idaho Power Company
Idaho Power Company (IPC) is headquartered in Boise, and while IPC's service territory is primarily in Idaho, it also extends into parts of Eastern Oregon including Ontario and outlying areas extending west, near Baker City, John Day, and Prairie City. Past estimations reveal IPC's broadband network reaches about 135 route miles in Oregon. IPC uses this system for two-way radio communication, generation and/or transmission energy management, along with

implementing and monitoring responses to power disturbances, inter-connections with other utilities, and security operations.

Within Oregon, IPC owns and operates communications facilities including microwave terminals, microwave repeaters, and transmission switching stations. In the past, IPC's broadband capabilities have ranged in data rates as low as 12.35 Mb/s and as high as 360 Mb/s. IPC has also utilized commercially-owned telecommunications facilities and leased approximately 240 miles of broadband facilities for carrying AMI service and distribution substation energy management EMS. At least some of its Oregon substations have used leased communication facilities.

Broadband technology has also been used in IPC's Irrigation Peak Rewards Program for backhaul communication between IPC's substation data collectors and the utility enterprise network, but this did not include communication with individual meters or devices. Idaho Power also has a web portal that customers can access for energy monitoring purposes, but it does not broadcast this information to customers using broadband technology.

PacifiCorp
PacifiCorp (PAC), headquartered in Portland, serves approximately 614,000 customers in Oregon. PacifiCorp also serves retail customers in the states of California, Idaho, Utah, Washington, and Wyoming. PAC's Oregon service territory includes sections of Portland, the Coast, Willamette Valley, as well as Southern and Eastern Oregon.

Given PAC's Oregon customer base, and its diverse service area, it has a rather extensive privately-owned data network. PAC also leases broadband circuits to supplement its private network where it is cost prohibitive to internally expand. PAC has in excess of 1,000 route miles of broadband capability in Oregon related to electrical grid operations. PAC uses this network for two-way radio communication, remote site access, supervisory control, data acquisition (SCADA) of substations and generation sources, implementing and monitoring responses to power disturbances, inter-connections with other utilities, and security operations. Speeds on the private network range from 1,200 baud serial for polling radios to 10 GigE for fiber optic communications (with planned 100 GigE links in the future).

In addition to this capability, PAC recently began deployment of AMI in Oregon. PAC has stated that it intends to develop AMI technology in an effort to reduce operating costs and improve customer service. PAC began placing these smart meters into service in January 2018. PAC will be deploying its AMI network by leveraging broadband networks provided by commercial wireless providers for network backhaul. The meter-to-collector network consists of an IPv6 mesh network built around the IEEE 802.15.4g standard, commonly referred to as WiSUN (Wireless Smart Utility Network).

Portland General Electric
Portland General Electric (PGE), also headquartered in Portland, currently serves around 840,000 customers within a 4,000-square-mile service territory, which focuses on the Portland Metropolitan area as well as the Willamette Valley. PGE uses a combination of owned and leased fiber at all of its generation plants and transmission and distribution substations for

broadband services. Given the need for minimal delay, high reliability and redundancy, fiber is used for both operations monitoring and control. PGE utilizes a range of speeds on its system, from 56Kbps to 10 Gbps/s (moving to 100 Gbps/s in the near future). Data to and from retail meters is transmitted over a wireless network at very low speeds.

PGE also has about 90 substations with low speed connections and about 50 that use cellular connections. PGE has begun the process to move those connections to a leased broadband MPLS system. This change will take approximately 5 years.

In 2015, PGE completed its Outage Management System (OMS), which uses input from AMI, SCADA and customer calls. The intent of the OMS upgrade was to pinpoint, collect information about, and respond to outages more quickly. However, PGE currently has no plans for expanding its broadband to include connection to customer meters.

PGE has also launched a smart water heater demand response pilot program that uses customers' own Wi-Fi networks (enabled through existing broadband-based internet service providers) to communicate with PGE, in combination with a simple FM radio network that broadcasts control signals. In this program, customers allow PGE to connect to their home water heaters and ramp them up or down, with these control events occurring on a daily basis. This allows a matching of supply and demand through adjustments to the appliances of residential customers. In this way, PGE gets the benefit of existing broadband networks without the expense of installing its own dedicated fiber.

Customer Owned Utilities (COUs)
There are 41 COUs in Oregon: 20 electric cooperatives, 12 municipal electric utilities, and 6 people's utility districts (PUDs). While COUs serve more than two-thirds of Oregon geographically, they only serve about 26% of Oregon's population. Smart grid related deployments in this group vary from very aggressive deployments to no deployments at all. A lack of broadband infrastructure is a significant barrier to smart grid deployments in some rural areas. Several COUs have built their own fiber optic communications infrastructure while many rely upon the infrastructure of local communication providers. Some have a combination of their own fiber optic infrastructure and service from a local communication provider. Twenty Gbps was cited as the fastest speed utilized. Nearly 1,450 miles of fiber optic cable was cited as the largest deployment of fiber optics under one COU's control. Aggressive deployments include AMI and SCADA at substations with some planning to deploy Distribution Automation (DA) on their local electric distribution systems in the future. Smart Grid applications are designed to save costs, reduce outage time, and improve both internal and customer communications.

Current applications of Smart Meters include:
- Reading meters remotely
- Energy use monitoring by the customer via smart phone or PC
- In-home energy use displays of customer electric usage
- Outage management systems (OMS)
- Outage detection by the utility
- Outage notification via smart phone or PC to customers

- Outage progress updates via smart phone or PC to customers
- Outage map viewing by customers via the web
- Social media outage notification and progress updates
- Automated pre-pay programs that eliminate the need for sending electric bills
- Remote connect/disconnects
- Load control
- Current applications of SCADA include:
- Substation monitoring of internal equipment
- Substation video monitoring
- Remote switch operations
- Remote fault detection
- Load control management

Other Applications include:
- Conservation voltage reduction (CVR)

A note about Smart Meters: Current and pending Smart Meter deployments increased from 85% in 2016's *Broadband in Oregon Report* to 95% in this report. The increased percentage refers to all electric meters in Oregon. As reported by the US Energy Information Association in December 2017, nearly half (47%) electric customers in the nation have smart meters. Oregon far exceeds the national average. Most smart meter deployments utilize Power Line Carrier (PLC) with the remainder being Wireless Mess (RF).

A note about COUs providing broadband to others: Seventeen COUs either directly or indirectly provide broadband to their local communities. Some provide wholesale broadband services while others provide retail and wholesale broadband services. Services generally are provided via a subsidiary or by intergovernmental agreement (IGA) with others. Some are wholly-owned by the COU or are in partnerships corporations, LLCs or IGAs. A few provide wholesale broadband services directly from the COU. Some COUs that don't currently provide broadband are in the process of seriously considering providing broadband services.

Education
"Every student in Oregon deserves the opportunity to learn and thrive. We are committed to expanding access to a world of knowledge and skills by improving the reach of high-speed internet and digital learning in classrooms in every Oregon community."
- Governor Kate Brown

K-12
Oregon continues to make significant progress regarding broadband in K-12 schools since the OBAC's 2016 report. One of the most significant accomplishments occurred In April 2018, when the Oregon legislature passed HB 4023, which created the Connecting Oregon Schools Fund.

E-rate Federal Funds Background

The Federal Communications Commission (FCC) Schools and Libraries (E-rate) Program provides discounts to assist schools and libraries in obtaining affordable internet access and network equipment. Discounts range from 20-90% of the costs of eligible services, depending on the level of poverty and the urban/rural status at the school district level.

To motivate state leaders to fund new broadband construction, the FCC unveiled a new dedicated state match in its December 2014 E-Rate Modernization Order. State match funding was first made available to applicants in FY2016. Under these new rules, the FCC would provide eligible applicants with an up to 10% additional discount for special construction charges, matching state funding for the project on a dollar-to-dollar basis.

A district with a 40% discount can receive up to an additional 10% of E-rate funds if the state provides an additional 10% of the cost of the special construction project. Applicants with higher discount rates that utilize these funds have the opportunity to significantly or completely eliminate their payment obligations.

The FCC adopted bandwidth targets that were recommended by the State Education Technology Directors Association (SETDA) calling for:
- An external internet connection to the Internet Service Provider (ISP)
- At least 1 Gbps per 1,000 students/staff, and
- Internal wide area network (WAN) connections from the district to each school and among schools within the district
- At least 10 GBPS per 1,000 students/staff

Pilot Project

In May 2016, the Legislature appropriated $252,762 to the Oregon Department of Education to support 6 pilot school districts with state match funds. These were districts that had plans in place and were ready to begin construction. These state matching funds enabled six local school districts to receive an additional $1,988,210 of federal resources for project cost. These funds combined with $172,000 of local school districts ensured the completion of all six projects and provided for a 1:10 leverage with the state investment.

Results in one region of the state: South Wasco, Dufur, and Sherman County:
Number of Students Impacted: 3,800

Prior to Build:
- South Wasco—30 Mbps Microwave internet
- Dufur School—30 Mbps Microwave internet
- Sherman County SD—30 Mbps Microwave internet

Post Fiber Build:
- All Schools (10 GBPS per 1,000 users)

In terms of the approximately $60 million estimated cost for the remaining schools and districts, we are assuming the same type of leveraging of resources (both federal and local).

Following the passage of HB 4023 and the creation of the Connecting Oregon Schools Fund, the Oregon Department of Education submitted a request to the E-Board for funding for six districts to enable them to take advantage of the 10% state match for E-Rate construction. Based on the USAC applications submitted before March 22, 2018, ODE determined that six school districts with standard discount rates at 70 percent or higher, had requested funds for special construction at a total cost of $5,675,574. Based on the approved discount for each of these school districts, a state contribution of $340,187 from the Connecting Oregon School Fund would be needed to provide for a 1:1 match for each district to address their funding gap. The table below provides a summary of each project.

School District	Project Cost	FCC Discount	FCC Funds	Original Funding Gap	State GIA Match	FCC Increase	Final Funding Gap
Mt. Angel	$15,000	80%	$12,000	$3,000	$1,500	$1,500	$0
South Lane	$1,068,167	80%	$854,534	$213,633	$106,817	$106,817	$0
Dufur	$438,426	90%	$394,583	$43,843	$21,921	$21,921	$0
Imbler	$45,000	80%	$36,000	$9,000	$4,500	$4,500	$0
Huntington	$3,300,000	90%	$2,970,000	$330,000	$165,000	$165,000	$0
Elgin	$808,981	90%	$728,083	$80,898	$40,449	$40,449	$0
Total	$5,675,574		$4,995,200	$680,374	$340,187	$340,187	$0

If this request for funds is approved, ODE would provide $402,037 in grants to each school district upon confirmation from USAC that the project application is accepted. Once each project is complete, the department will release funds to match the additional USAC contribution for each district. While this provides identification of school districts and the funding amounts needed, it limits many school districts that may have applied if there had been sufficient time to complete their applications.

To optimize the use and impact of the Connectivity Oregon Schools Fund, we recommend the Legislature consider capitalizing the fund to incentivize school districts to apply. Many school districts lack adequate internet connectivity, but traditionally do not apply for E-rate funds due to their inability to resolve the funding gaps that remain. In February 2018, it was estimated there were 43 school districts and charter schools without access to high-speed internet, yet only six successfully applied for a fiber construction project that could help meet this need.

According to the Education SuperHighway, a nonprofit corporation focused on upgrading the internet access in every public school classroom in America, 95% of Oregon's school district can access the internet at speeds of 100 kbps per student, the minimum broadband standard.

95% of school districts can access the Internet at speeds of 100 kbps/student.

75%	84%	90%	95%
2015	2016	2017	2018
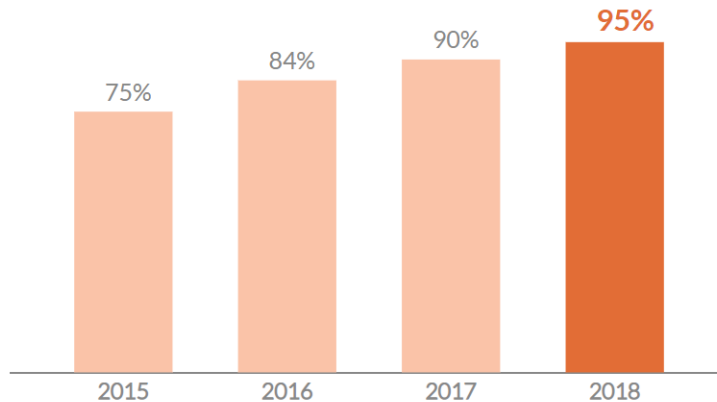
Oregon School Districts with minimum standard broadband

There are at least 45 districts across Oregon, however, that do not have robust and reliable high-speed access to the internet. Elgin School district is one example, fiber runs between Elementary School to the grain elevator a couple blocks away. A radio tower on the grain elevator bounces the signal to Mt Fanny, a mountain on the other side of the Grande Ronde valley. Radio on Mt Fanny bounces to La Grande EONI offices (ISP provider). La Grande EONI offices have fiber to La Grande IMESD facilities. Fiber connects from IMESD facilities to EOU-NERO. If there are outages on the wireless radios it can take several hours on a snow cat machine to climb Mt Fanny and fix. We have had numerous outages over the 2 years of service.

Images courtesy of Jeff Crews, Eastern Oregon Net, Inc.

If the Oregon Department of Education was able to provide funding commitments to school districts early in the application period, which starts 10-12 months before the E-Rate application deadline, it is likely funding would be leveraged even further with a greater statewide impact. The Legislature needs to consider allocating monies to the Connecting Oregon School Fund to provide increased opportunities for the 2019 funding cycle.

The Benefits of Increased Broadband Connectivity

Learning in the Digital Age
- Customize and personalize learning
- Enhance career and college ready standards
- Enable 1:1 digital learning initiatives
- Access high-quality digital content and courses, regardless of geographic location, through distance learning

Educator Effectiveness
- Real-time tracking of student progress
- More efficient planning and prep requirements
- Online access to professional learning resources

Schools and Libraries as Technology Hubs
- Boost access to education and jobs among local communities.

Learning in the Digital Age

SETDA provides a number of resources to support states in their work around broadband, digital learning, accessibility, data interoperability, instructional materials, professional learning and technology planning. In September 2017, SETDA, in collaboration with Education Networks of America (ENA), published the *State Wi-Fi Leadership for Fostering Digital Learning Ready K–12 Schools: Extending the Broadband Imperative II* report. This report builds on SETDA's earlier publication *Broadband Imperative II: Equitable Access for Learning* and *State K–12 Broadband Leadership: Driving Connectivity and Access.* The State Wi-Fi Leadership report provides insights on Wi-Fi implementations including the importance of state leadership, teaching and learning goals, pathways to successful implementation and Wi-Fi design. Another resource, the Transformative Digital Learning tool is a guide for implementation, addresses ate planning and Key Components: policies, leadership, sustainable funding. This tool is filled with resources covering digital transformation, collaborative leadership, digital learning plans and facilitator guides that provide step by step activities to help drive transformation in a district.

Our districts with robust and reliable access, are creating opportunities for many of our students to use technology addressing the International Society for Technology in Education standards for students at school and at home. Students are becoming Empowered Learners, Digital Citizens, Knowledge Constructors, Innovative Designers, Creative Communicators and Global Collaborators. Many students are also learning computer science and addressing the K-12 Computer Science Standards and Framework from the Computer Science Teachers Association (CSTA). The Oregon Department of Education, stakeholders and partners will be reviewing these standards and looking at how to address our need for these types of standards and the critical shortage of educators trained to provide these learning opportunities for students.

Oregon students face two major gaps. The first is access to educators who have the ability to provide learning opportunities that call for students to be using technology for learning, creating, communicating and addressing standards like ISTE's Standards for Students and CSTA's Computer Science Standards. The second major gap is access to robust and reliable broadband at school and also at home; the homework gap. Students face the homework gap when they do not have access to robust and reliable internet at home. As more schools incorporate internet-based learning into a student's day this gap has widened. Research from the PEW institute indicates most American homes with school-age children have broadband access (82.5%). Approximately 5 million households with school-age children do not have high-speed internet service at home. Black and Hispanic households make up a disproportionate share of households without high-speed internet service. (Source: Horrigan, John B., *The numbers behind the broadband "homework gap,"* April 20, 2015.http://www.pewresearch.org/fact-tank/2015/04/20/the-numbers-behind-the-broadband-homework-gap/)

One way that the Oregon Department of Education is trying to close the rural student opportunity gap is through the Oregon Virtual School District (ORVSD-ORS 329.840). ORVSD provides students in Oregon's small and rural districts with flexibility and personalization to meet their desired pathway for career and college. These courses supplement the district's offerings allowing students greater diversity than what might otherwise be available in a small school. The students enrolled in ORVSD courses remain the students of the local district. Another benefit to

schools with limited teaching staff, is that ORVSD enables the school to ensure that students have access to the courses they need to follow their desired career pathway.

Each year for the past three years, we have reached capacity for this program. The plan is to expand the course offerings to include classes that help districts complete a CTE Program of Study and to make a greater number of course enrollments available to all districts with a focus on Oregon's small and rural districts. The Oregon Department of Education has submitted a Policy Option Package that would allow for the ORVSD program to grow over time.

In order to take advantage of this online learning opportunity, schools and communities need access to robust and reliable high-speed broadband connectivity.

Educator Effectiveness

Oregon has 197 school districts; 138 of these are rural or frontier. Distance from the urban centers such as Salem, Portland, and Eugene are often a challenge for attending professional learning opportunities. In order to address this challenge, the Oregon Department of Education created the Oregon Educator Network (OregonEdNet).

The OregonEdNet was created to provide a space for educators to connect all across Oregon. It supports collaboration between educators in schools, districts, ESDs, community colleges, universities, professional organizations, and hubs such as the Oregon STEM hubs. The OregonEdNet is a vehicle for educators who want to connect with others who are working on the same content, trying to develop solutions, or who want to find and share resources. The distance between schools or institutions is no longer a barrier to collaboration. Whether you're in a crowded metro area, or one of our many rural towns, the Oregon Educator Network supports P-20 educators connecting with their colleagues.

With the OregonEdNet, educators can:
- Engage in professional dialogue with peers;
- Share, discover, rate, and discuss educational resources;
- Find strategies to engage learners at all levels;
- Form and participate in groups based on content, professional organizations, professional development cohorts, or any topic of interest;
- Find events and professional development opportunities.

The OregonEdNet continues to grow and support educators across the state. In the past 6 months, over 1000 users have signed up for an account! Educators are using this tool to connect with statewide workgroups, such as the High School Success Graduation Coach Networking group. Using these groups, educators can hold conversations to work through challenges or encourage each other, share resources and best practices, and keep up with the latest news from the group. Educators use the OregonEdNet's Strategies database to search for tried and true instructional strategies to use with students or in professional development settings. The OregonEdNet hosts an event calendar that allows any organization to share their professional learning events, which means educators can search one calendar for professional learning opportunities to meet their needs.

Schools and Libraries as Technology Hubs

School districts like Beaverton have realized the important role of school librarians. Beaverton invested in "library instructional technology teachers." Following an investment in technology including a computer for every student, the district saw the need for somebody to guide the use of technology and curation of the digital learning resources.

Come for the Computers, Stay for the Books: https://slate.com/technology/2017/06/libraries-are-becoming-tech-hubs-for-schools.html

Beaverton is one of thousands of schools across the nation working with the Future Ready Librarians initiative. "Future Ready Librarians™ is an expansion of the Future Ready Schools® initiative aimed at raising awareness among district and school leaders about the valuable role librarians can play in supporting the Future Ready goals of their school and district." These initiatives are provided by the Alliance for Excellent Education. https://futureready.org/program-overview/librarians/

Education Related Broadband Definitions

- Broadband: High-speed internet access. Broadband includes several high-speed transmission technologies including: Digital Subscriber Lines (DSL); Cable Modem; Fiber; Wireless; Satellite; and Broadband-Over-Power lines.
- Last Mile/Wide Area Network (WAN): School districts and library systems frequently connect individual schools and libraries at a central aggregation point, such as a district, county, or regional data hub. We refer to these connections as "last mile" or Wide Area Network (WAN) connections.
- E-rate Special Construction: The upfront cost of deploying new facilities (typically fiber), in contrast to the recurring cost of having access to facilities.
- Fiber: Fiber optic technology converts electrical signals carrying data into pulses of light and sends them through transparent glass fibers about the diameter of a human hair. A "fiber build" refers to constructing the glass fibers that will provide internet access.
- Internet Access: School districts and some library systems purchase internet access for the entire district or system at a single point of aggregation. "internet access" is the connection or connections that allow traffic to flow from that aggregation point to the public internet.

Higher Education

Oregon State University has a goal that 100 percent of its students have an experiential learning experience upon graduation; that means direct access and participation in research. Higher education's challenge is effectively managing the collection, transport, and storage of ever increasing amounts of data for science and discovery. Transporting data has become the bottleneck. Not only science and engineering students, but language and arts student rely increasingly on data stored and accessed on line for their studies. OSU's Earth, Ocean and Atmospheric Sciences College research is amassing large amounts (hundreds of terabytes) of data using drones for the study of the oceans and fisheries.

OSU is now using Amazon's "Snowball" service https://aws.amazon.com/snowball/ as a means for transport for some data transport applications that exceed the capacity of the University's network. The University's data transport needs have outstripped the capacity of its networks. In September 2013, OSU had a single researcher working on a climate model transmitted 500

terabytes of data to a server in the "cloud." This one transmission took five days and consumed all of the University's Internet access capacity.

Oregon State University is home to the state's agriculture extension mission. Agriculture is a discipline in which there is a growing application of sensors and intelligent devices being used to collect, process and communicate data. Here again, data transport needs are exceeding the University's network capacity as well as the availability of telecommunications infrastructure.

Oregon's universities operate with in an ecosystem of research universities competing for federal grants nationwide. Connectivity standards require a minimum of 100 Gigabits (Gbps) connectivity. In five years, that standard will be multiple 100 Gbps of required bandwidth and growing to Terabit (Tbps) connectivity.

Oregon is not viewed (though the perception may be wrong) as competitive with California and Washington, and is not being included in research consortia or projects as a result.

The University of Oregon, Oregon State University, Oregon Health and Science University, and Portland State University are working together on the *FiberOregon Partnership* to create a managed fiber backbone network to address these needs, and which has also been joined by the Office of the State CIO to meet the needs of State Government. Dark fiber has been leased across Oregon and will be lit and managed by the Universities and OSCIO.

Oregon State University serves about 31,000 students on three campuses (Corvallis, Bend, & Newport) and through an E-Campus program that is ranked in the top ten in the nation. There are 45 degree programs available on line, though many traditional on-campus students also use the program. The OSU main campus in Corvallis is upgrading to a Main campus upgrade to 100 GB network and will be increasingly leveraging cloud-based services. Systems are proactively using data to track individual student performance and to trigger counseling and other institutional services. OSU produces over three hundred reports based on data collection on a range of topics.

Bandwidth use at universities is growing. There is a movement away from traditional classroom instruction. Classrooms are increasingly designed around student interaction vs. lecture and utilizing IT. Landline telephone services for dormitory rooms is no longer provided by the University. Students bring and use their own mobile wireless service and device but do have access to University provided WiFi internet access service that has high bandwidth utilization.

The Internet of Things is a growing application area for on and off campus applications.

Digital skills are critical for student success, and there is a gap in student digital skills between students that have been active users of information technologies in K-12 schools and those that have come from areas without those services, as well as between traditional students and non-traditional older students who are returning to school prompting increasing collaboration and information sharing between K-12 and Higher-Ed schools. Significant progress has been made over the past five year in defining and addressing the broadband access issue and in deploying infrastructure.

E-Government

State of Oregon

Oregon relies on a robust web presence, www.Oregon.gov, to provide information and services. In 2017, an Oregon.gov website supported by the Department of Transportation received the AVA Digital Awards, Gold Award for best web redesign. The talented people throughout Transportation leveraged the Oregon.gov templates to create this mobile-first, useful and usable website.

In the 2017 E-Government Survey of Oregonians, seventy-five percent emphasized that it is important for state of Oregon websites to be optimized for smart phones and tablets. One in every three visitors come to Oregon.gov from a mobile device. Since the 2016 *Broadband in Oregon Report*, Oregon.gov received 35,600,000 additional mobile device visits. In 2017 alone, 26 new mobile-enabled services came online raising our total to over 120 mobile services.

Visitors have access to more than 1,900 Oregon services where they can complete their entire interaction over the internet.

The survey of Oregon residents has pointed out that online services are faster (64%), more convenient (72%) and more useful (57%) that traditional services. In Oregon, almost all residents (97%) report having internet access at home or have internet access from somewhere else. Only 3% of Oregonians did not have access to the internet.

Last year, Oregon residents visited Oregon.gov webpages 53 million times viewing more than 161 million webpages.

The Electronic Portal Advisory Board (EPAB) publishes three key measures: 1) Survey of Oregonians 2) Number of Online Services 3) Agency Defined measures. These three cover 80 different measures published once a year in the EPAB Annual Report.

In 2017, the E-Government ecommerce service collected more than 2.4 billion dollars in over 3.3 million transactions. This is in addition to the other online payment services provided by the Treasurer's office.

The new Oregon.gov website templates have been designed to be compliant with the Web Content Accessibility Guidelines 2.0, level AA for the blind and those with special needs. American Sign Language (ASL) workshops have begun to assist agencies on producing "how to" sign language and closed caption web-based videos for the deaf and hard of hearing community. ASL instructional videos are not beginning to appear on Oregon.gov webpages and YouTube.

Nearly every agency, board, commission, and branch of state government participates in the centralized Oregon E-Government service offering, including websites, online applications, online payments, open data and enterprise collaboration.

The Electronic Government Portal Advisory Board publishes the future projects under consideration as a handout at each quarterly board meeting: http://www.oregon.gov/epab/pages/agenda_minutes_handouts.aspx

To review the full 70-page annual Oregon.gov report go to: https://www.oregon.gov/epab/docs/2018-EPAB-Annual-Report.pdf

Oregon Cities
The League of Oregon Cities conducted a survey to measure the use of the internet and e-government and received responses from ninety-seven Oregon's cities.

Key findings
- 88% of the respondents maintain an internet website.
- 8.6% provide streaming video of city council meetings.
- 20% provide transactional services, e.g., paying invoices and obtaining permits.
- 8.25% provide broadband access services (66.67% do so with optic fiber networks and 33.3% do so with unlicensed wireless networks)
- Public policies regarding broadband are focused primarily on permitting the location of infrastructure, and not on the use of broadband for economic development or problem solving.
- Broadband infrastructure is viewed as being important for economic development.

Oregon Counties
The Association of Oregon Counties conducted a survey to measure the use of the internet and e-government and received responses from one hundred percent of Oregon's counties. Counties in Oregon continue to utilize technology to reach out and make government accessible to citizens.

Key findings
- 100 % of the respondents maintain an internet website.
- 94% of the websites are used to provide and distribute general civic information to residents.
- 100% of the websites are used to provide information about county government and its activities.
- 50% of the websites are used to broadcast county commission meetings and/or other public meetings via streaming video.
- 53% of the websites are used to provide transactional services such as paying invoices and obtaining permits.
- 11% of the websites include information about the county's broadband infrastructure.
- 17% of the counties are a provider of broadband services.
- 14% of the counties have established any public policies regarding broadband.
- 39% of the counties have engaged in any e-Government or broadband telecommunications projects in the past two years.

Tribes

There are nine federally recognized Tribes within the boundaries of the state of Oregon.
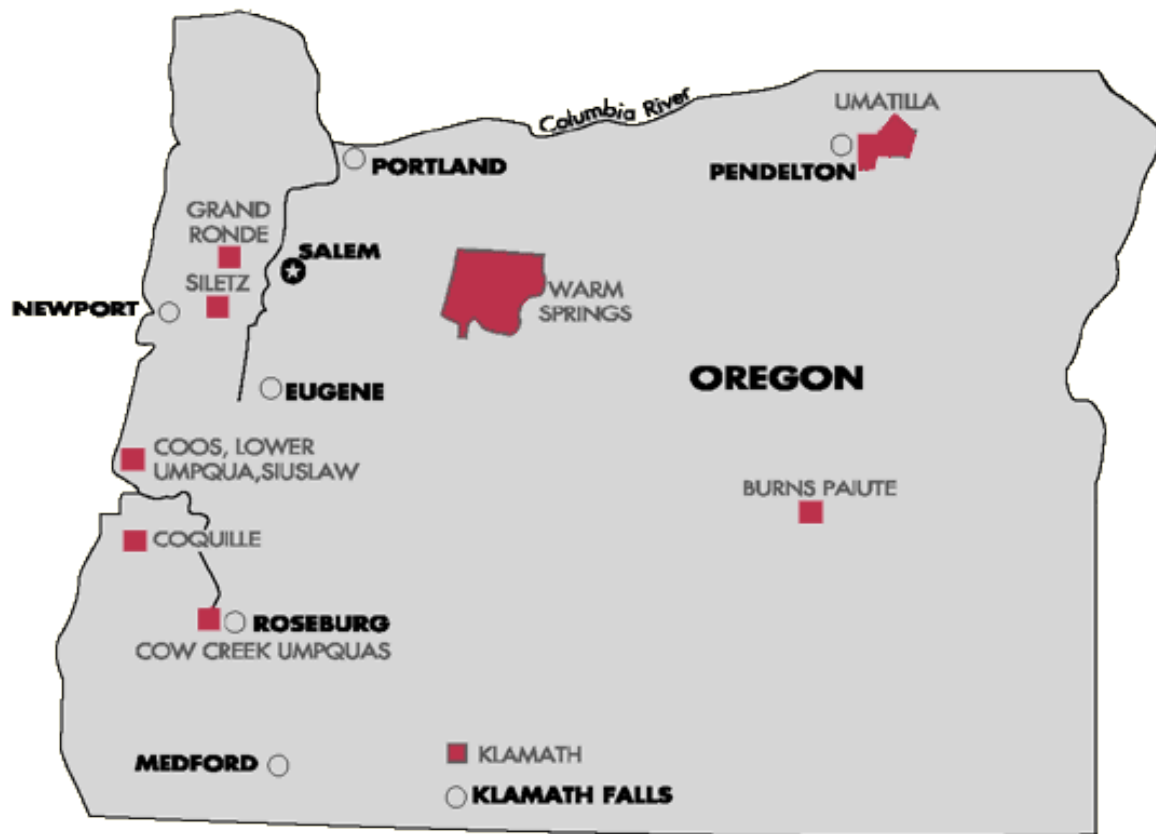
Oregon federally recognized Tribes

All of the recognized Tribes have websites that provide information about governmental services that include information on tribal law and code, plans, forms, permits, public meeting notices, agendas, meeting minutes, job announcements, maps, e-mail contacts for staff and elected officials, social networking. A few have exclusive portals for information sharing within the tribal organization.

Only one Tribe offers extensive streaming video of public meetings.

Online bill or fee pay, and online forms submission is still very limited. A couple tribes offer online purchasing of recreational fishing permits.

Tribe	URL	Resources Offered
Burns Paiute Tribe	http://www.burnspaiute-nsn.gov/	Tribe organizational contacts Tribe employment opportunities Social Services Police and Court Services *The Tribe website will be updating throughout the months of October and November.
Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians	http://ctclusi.org/	History of the tribe Human Resources & Employment Housing Department Veteran Resources
Confederated Tribes of the Grand Ronde	http://www.grandronde.org/	History & Culture Housing Tribal Events Employment
Confederated Tribes of the Umatilla Indian Reservation	http://ctuir.org/	History & Culture Tribal Services (education, housing, planning, etc.) Employment Tribal Government
Confederated Tribes of the Warm Springs	http://www.warmsprings.com/ https://warmsprings-nsn.gov/ (Tribe government website)	Culture Events Employment
Confederated Tribes of Siletz Indians	http://www.ctsi.nsn.us/	History & Heritage News & Events Tribal employment Tribal government
Coquille Indian Tribe	http://www.coquilletribe.org/	Heritage Health care Employment Tribal news
Cow Creek Band of Umpqua Tribe of Indians	http://www.cowcreek.com	History Tribal government Employment
Klamath Tribes	http://klamathtribes.org/	History Tribal permits Employment Department (Human resources, education, social services) Tribal news

Oregon Tribe Websites

Blue Earth Services and Technology, LLC (BES&T) was founded in 2015 and is a wholly owned subsidiary of the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians. BES&T is doing business as a full-service Surveillance Camera, Voice, and Data Network interconnect company providing service to other businesses and institutions for education, government and health care. They have extensive knowledge and training in structured cabling, including Cat5, Cat5e, Cat6, and fiber optics, and are certified resellers for Iwatsu APS and ECS, NEC, Windstream, and Panasonic telephone systems.

The Cow Creek Band of Umpqua Tribe of Indians operates a level-3 commercial data center out of Roseburg.

In August 2016, Warm Springs Telecommunications Company (WSTC), a certified Competitive Local Exchange Carrier (CLEC) and Eligible Telecommunications Carrier (ETC) in Oregon, filed a petition with the FCC to be treated as the Incumbent Local Exchange Carrier (ILEC) of record. The FCC has not yet acted on the petition. The WSTC recently hired a new Operations Manager.

A 2018 GAO report finds that the FCC overstates access to broadband on Tribal Lands, and recommends collecting targeted data specific to tribal lands, and to develop and implement data collection methods and processes that are specific to tribal lands and people. The report also recommends that the FCC obtain feedback from tribal stakeholders on how a previous FCC statement guiding providers on how to engage tribes for input is being fulfilled and whether there is a need for clarification. (GAO-18-630)

Broadband Technology Role in Local, State and Regional Economies and Economic Development

Broadband is the most important differentiating infrastructure today and is critical to the economic competitiveness of local businesses, and the well-being of residents. Moreover, education, healthcare, business operations, workforce training and readiness, and smart community services all rely upon advanced broadband networks. Research by the Strategic Networks Group research indicates that local economic growth and secondary investment enabled by broadband is 10 times the initial broadband investment and the contribution to Gross Domestic Product (GDP) is 15 times the initial investment.
http://sngroup.com/about-sng/defining-broadband/

Key applications are enabled by broadband that contribute directly to economic and community development.

E-commerce is emerging as a powerful strategy for businesses of all sizes *wherever* they may be located. It enables small businesses in small towns to effectively compete in and serve national and international markets and provides important opportunities for economic development.

E- Government applications have proven to be an extremely effective way to deliver up to date information as well as transactional services and access to government proceedings to residents and is widely used by federal, state and local governments.

Telework or Telecommuting enables people to work from physical locations other than their employer's with network access equal to or in some cases better than they get in the office. This application offers tremendous opportunities for increased productivity, improved energy management, and reduced traffic congestion as workers are able to stop driving for forty minutes to get from one computer screen to another.

Telemedicine, delivering clinical services and patient consultations remotely using telecommunications offers one of the few viable strategies for improving and maintaining access to healthcare in small town and rural America. Virtual Care is an increasing popular new term for telemedicine.

Distance Learning or On-line Education for instructional delivery that does not constrain the student to be physically present in the same location as the instructor. It is increasingly being used for K-12 up through post-graduate education and workforce development with excellent results.

Public Safety
Broadband has tremendous potential for public safety communications giving first responders in the field the ability to send and receive voice, text, images, and video. We have work to do in this area.

The Oregon Broadband Advisory Council with the assistance of the Oregon Economic Development Association https://oeda.biz/ conducted a survey of its member Economic

Development Organizations in Oregon regarding the role of broadband in local economies and in economic development. The survey had a 45% response and 88% of the fifty-three respondents serve territories that include rural areas.

Business Oregon defines "rural" as any area having a population of 30,000 or less. (Business Oregon, 2017, p. 30) Chart B below shows the population distribution of the survey respondents bore out the rural/urban findings. Of the respondents, only 36% said that they lived in an area with a population greater than 30,000, while 64% stated that they lived in areas with 30,000 or fewer residents.

Most respondents felt that broadband had positively impacted economic development in their area and strongly believed that broadband helps individuals economically and helps economic development.
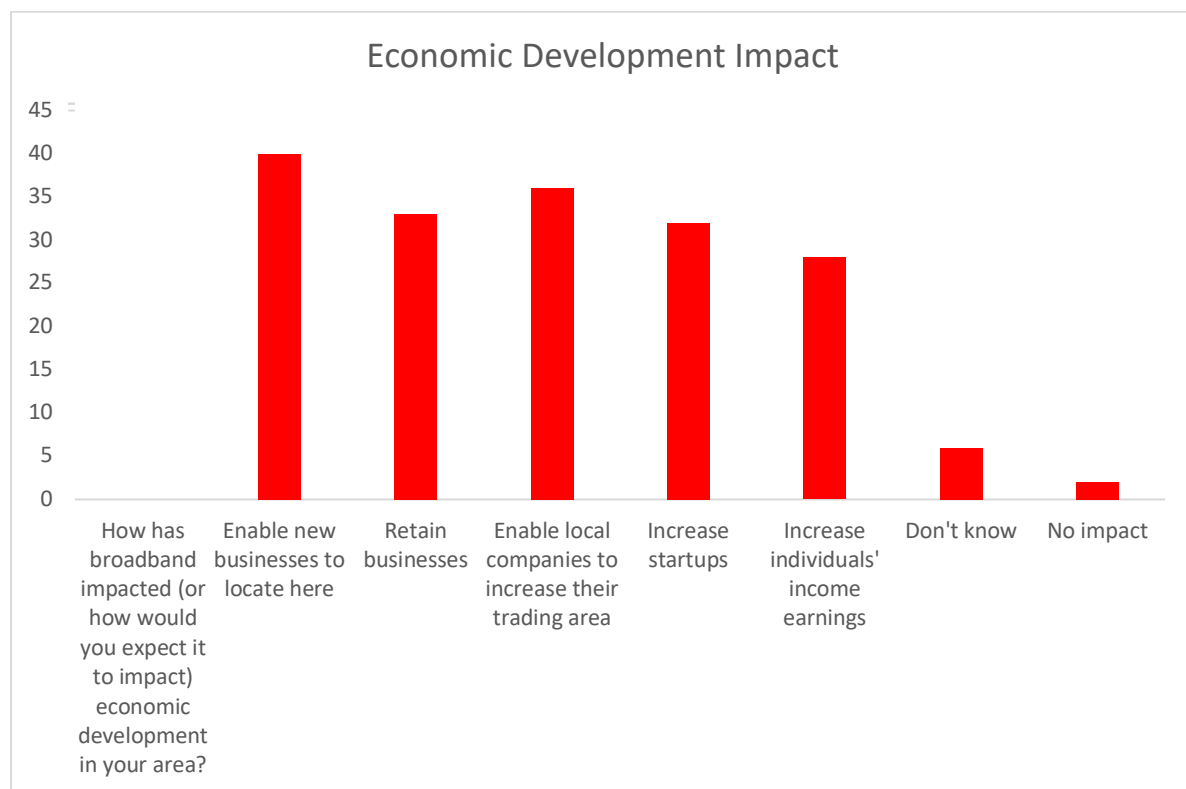
Economic Development Impact of Broadband

89% of respondents stated that broadband services encourage and enable individual entrepreneurship, including starting new businesses, growing existing businesses, and creating jobs. When asked if broadband access stimulates the development of home-based businesses, 96% of respondents said "Yes" or "Quite Likely." With regard to community broadband plans, 34% stated that they had a community economic plan that included broadband, while the rest either had no plan or had not incorporated broadband into their plan. 92% of respondents stated that Broadband had high, somewhat high, or moderate importance in economic development.

The survey results showed that economic developers think that there is a great deal of work to do, particularly in rural areas, to improve access to broadband. 2% of respondents said that broadband is discussed or implicated as an issue when talking with local businesses in the respondents' community, which could signal dissatisfaction with broadband access in those areas. To the question "is there sufficient broadband access and quality of service in your area to positively impact the economy, only 17% said yes, while 81% stated that no, the situation was OK for now but would need improvement, or that there was not enough availability, speed, or quality of service.
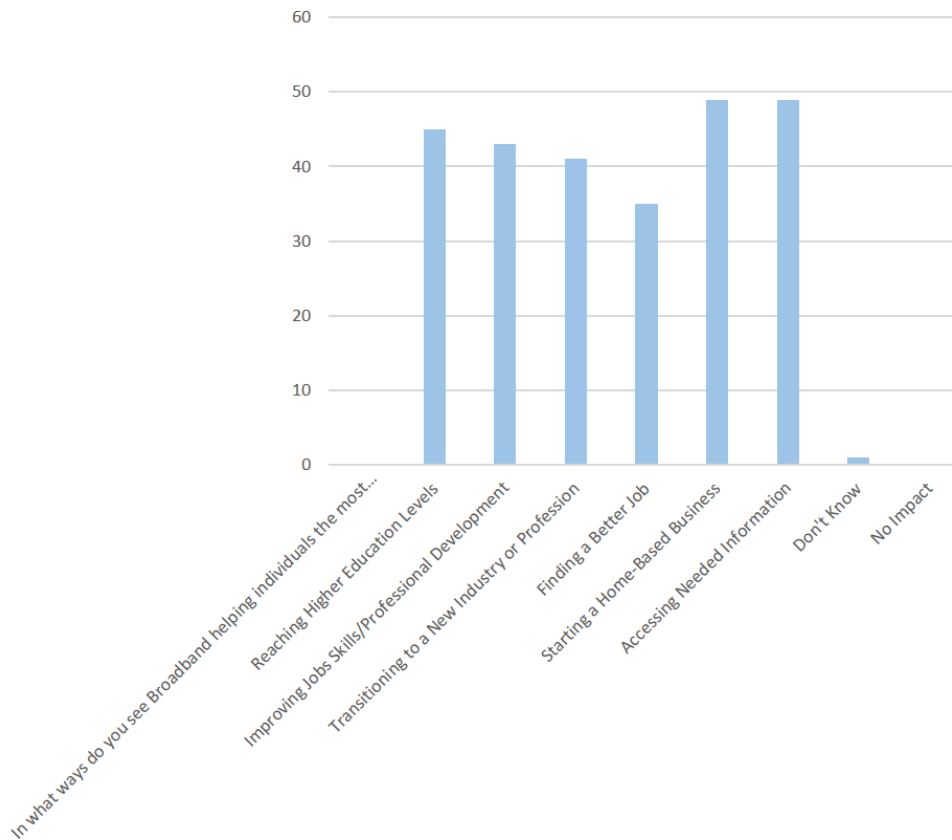

Economic help broadband provides to individuals

Data Centers

Oregon has become a prime location for data centers due to its robust telecommunications infrastructure, tax structure, climate, cost of electric power, and availability of water. Marquis companies such as Google, Amazon, Facebook, and Apple have served as anchor tenants raising Oregon's profile and reputation as a "digital state" attracting many other data centers to locations around the state.
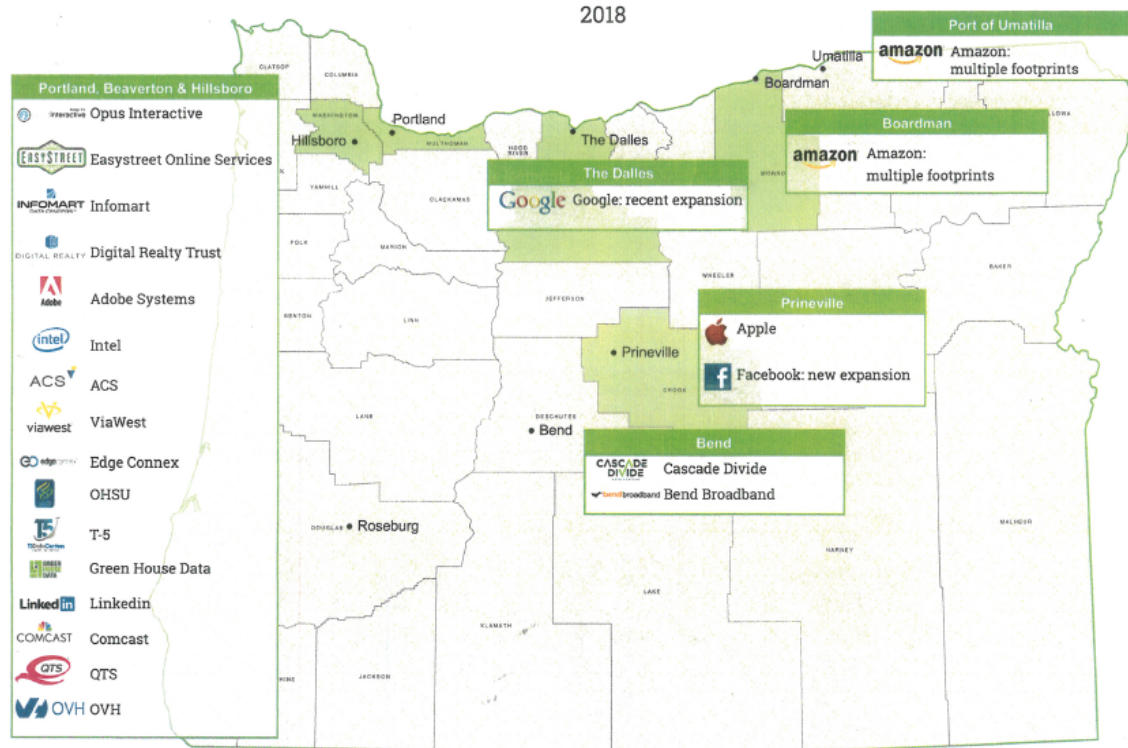
Data Centers in Oregon

One of the most prominent is Google, which located a data center in The Dalles in 2006, one of six data center campuses that maintain the company's extensive operations providing search engine, cloud computing and other web-based services. Google reports that in 2016, its data centers generated $1.3 billion in economic activity, including $760 million in labor income and 1,900 data center jobs in the U.S. In addition, facilities on the data center campuses are regularly upgraded and expanded to meet growing demand and to incorporate the latest technologies. On average, this effort employs more than 1,100 construction workers across the six campuses each year.

Google invested $1.8 billion in its Wasco County operation. As an "anchor tenant," Google has contributed to a data-center boom in the states in which they have located including Oregon, and has contributed to the growth of jobs, income and economic activity. Google estimates $67 million in Gross Domestic Product and $99 million in income generated in Oregon.

Google also reports that on-campus activity is further supported by an external supply chain that employs nearly 3,500 additional workers. As those employed directly on campus and in the supply chain spend their wages, a further 4,700 jobs are supported in the wider consumer economy, for example, in retail and leisure establishments. In fact, when these channels are considered, each direct Google data center job is found to support an additional 4.9 jobs throughout the United States (for a national jobs multiplier of 5.9). The Google data center in

Wasco County, Oregon, supports 696 jobs throughout Oregon. The data center's job multiplier is 3.5.

Google further notes that there are additional beneficial "soft impacts" on communities. For example, Google partners with communities on workforce development and education initiatives that both prepare the current workforce for positions in the new economy and increase engagement with young women and minority students interested in science and math. Our report includes a series of case studies that explore these softer impacts on the counties and surrounding regions where Google data centers are located. [Source: *Google Data Centers: Economic Impact and Community Benefit*, by Oxford Economics, April 2018.]

In 2016, Google data centers generated $1.3 billion in economic activity, $750 million in labor income, and 11,000 jobs throughout the United States. Included in the 11,000 jobs are an estimated 1,900 people directly employed on the data center campuses.

On-campus activity is further supported by an external supply chain that employs nearly 3,500 additional workers. As those employed directly on campus and in the supply chain spend their wages, a further 4,700 jobs are supported in the wider consumer economy, for example, in retail and leisure establishments. In fact, when these channels are considered, each direct Google data center job is found to support an additional 4.9 jobs throughout the United States (for a national jobs multiplier of 5.9).

Since 2006, Google has opened six U.S. data center campuses. Each is a state-of-the-art, world-class facility that enables the company to provide the search engine, cloud computing, and other Web-based services on which so much of the modern economy depends. To date, the company has invested $10.5 billion in these facilities, including $1.8 billion in Wasco County, Oregon.

In Oregon, where Google's first data center opened in The Dalles in 2006. These operations generate franchise fee revenue for host communities and some also share Google's focus on renewable energy, helping to spur growth in that industry state-wide. Google created 200 direct jobs and 1,335 jobs total.

(millions)		
GDP	**Income**	**Jobs**
OREGON RECURRING IMPACTS		
OPERATIONS		
Direct	$22.7	$20.7	200
Indirect	$20.8	$10.3	176
Induced	$14.5	$8.4	195
Operations Total	$57.8	$39.4	571
CONSTRUCTION		
Direct	$4.7	$3.8	71
Indirect	$1.8	$1.2	23
Induced	$2.3	$1.3	31
Construction Total	$8.8	$6.3	125
ALL CHANNELS		
Direct	$27.4	$24.6	271
Indirect	$22.5	$11.5	199
Induced	$16.8	$9.8	226
All Channels Total	$66.7	$45.9	696

Source: Oxford Economics, IMPLAN

Google Oregon Data Center Impact Summary

Broadband Related Challenges and Opportunities

OBAC has identified the following key broadband challenges and opportunities facing Oregon and on its agenda for 2018.

Digital Inclusion

Digital Inclusion refers to the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies. This includes:

- Affordable, robust broadband internet service;
- Internet-enabled devices that meet the needs of the user;
- Access to digital literacy training;
- Quality technical support; and
- Applications and online content designed to enable and encourage self-sufficiency, participation and collaboration.

Digital Equity is a condition in which all individuals and communities have the information technology capacity needed for full participation in our society, democracy, and economy. Digital Equity is necessary for civic and cultural participation, employment, lifelong learning, and access to essential services. Digital Inclusion must evolve as technology advances. Digital Inclusion requires intentional strategies and investments to reduce and eliminate historical, institutional and structural barriers to access and use technology.

Digital Equity ensures all individuals and communities have the information technology capacity needed for full participation in our society, democracy, and economy. Digital Equity is necessary for civic and cultural participation, employment, lifelong learning, and access to essential services.

Digital Equity means everyone has adequate access to and understanding of information and communications technologies regardless of socioeconomic status, physical disability, language, race, gender or any other characteristics that have been linked with unequal treatment.

Digital Inclusion is the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to, and use of, information and communication technologies.

The five elements of digital inclusion are affordable/robust internet service, internet-enabled devices, accessible digital literacy training, quality technical support, and relevant online content design.

The city of Portland is working with its partners Multnomah County and the Multnomah County Library to develop and implement its Digital Equity Action Plan. The plan may be viewed at https://www.portlandoregon.gov/revenue/73863. Goals for the plan include ensuring access to the internet and devices, culturally-specific training, empowering community partners, creating job opportunities for under-represented populations, and creating supportive public policy.

Portland's Digital Equity Action Plan, detailed strategic action project descriptions and other resources are available at www.portlandoregon.gov/DEAP.

Angela Siefer is Executive Director of the National Digital Inclusion Alliance (NDIA) https://www.digitalinclusion.org/ noted at the beginning of this year that she is not aware of any states that have established formal policies regarding Digital Inclusion. She hopes that Oregon will be a leader and adopter.

Cyber Security

Senate Bill 90 (2017) established the Center for Cybersecurity Excellence within OSCIO, and the Oregon Cybersecurity Advisory Council. The intent was to enlist a broad cross section of people from the industry, law enforcement, government and other subject matter experts. Anitian, Andrew's company, is a 23-year-old cybersecurity firm based in Portland and is the oldest such firm in the United States. OCAC is interested in building partnerships with stakeholders including the private sector, K-12 schools, local government, state government, and higher education.

Amazon Web Services (AWS) https://aws.amazon.com/ has pledged support for the council and the Center of Cybersecurity Excellence. Cybersecurity is ultimately a shared responsibility. Council Vision: We believe cybersecurity is a shared responsibility and must be accessible to all. Council Mission: Build tangible solutions to protect the digital lives of all Oregonians.

OSAC is working on a study with Portland State University's Center for Public Service of the cybersecurity needs, existing resources, and cybersecurity funding sources for the state of Oregon. The report is due by January 2018 and will guide next steps.

There are several key trends affecting Oregon
- Talent gap—need for cybersecurity expertise
- Growth of cybersecurity attacks (hackers have become businesses, many of which are better equipped, funded and organized than their targets)
- State sponsorship of cybersecurity attacks
- Increasingly aggressive hackers only need to be successful once, where defenders need to be successful all the time
- Hackers are using automation, machine learning, and artificial intelligence
- Growth of the Cloud—97% of businesses have some or all of their IT infrastructure in the Cloud
- Growth of the "Subscription Economy"

SB 90 also provides for the creation of a Cybersecurity Center of Excellence. OSAC is working on developing a Security Operations Center in Oregon to offer free or highly subsidized cybersecurity services and resources for Oregon institutions. Another dimension is creating a workforce development program that would work with community colleges and industry to build a base of cybersecurity professionals. This is a profession that is "hotter than hot," with excellent compensation and demand that is "through the roof."

Governor Brown proclaimed November 20, 2017, as "Oregon Day of Cyber" at an Oregon Tech event in Wilsonville, and officially launched the Cyber Oregon Cybersecurity Awareness Initiative. This Initiative is powered by an active consortium of technology companies, educational institutions, organizations, and state/local government agencies. Activities included Cyber Networking and Job Fair, Cyber Oregon Overview–TAO, remarks by Governor Kate Brown, and a Cybersecurity panel discussion. A [CyberOregon website](#) has been launched. OSAC is expecting significant private sector contributions and the prospect for federal grants to support its efforts.

Public Safety
FirstNet
The State Interoperability Executive Council (SIEC) has been working with the Office of the State Chief Information Office through the state single point of contact (SPOC) with, AT&T and the First Responder Network Authority on the rollout of FirstNet in Oregon following the State's decision to opt-in to the initiative at the end of December 2017.

FirstNet service is currently available in Oregon using all of AT&T's frequencies with built in service priority, pre-emption and local control for Oregon first responders that are FirstNet subscribers. The services utilized have received positive feedback from subscribers regarding performance and cost.

As of October 23, 2018 ,FirstNet has more than 3,600 public safety agencies across the country with more than 250,000 connections. That's a nearly 50% increase in the number of agencies subscribing to the nationwide public safety communications platform in less than 2 months.

While the full set of cost disclosures are available through state procurement as a NASPO addendum, some examples of pricing include the following.
- Unlimited data, voice and text, for Smart Phones including Mobile Hotspot $44.99 per month … $39.99 Unlimited Voice, Data, Text, and NO hotspot
- Unlimited data for data devices such as laptops and tablets is $36.80 per month.
- No Throttling and No Data Capping on any FirstNet Plans

The Oregon deployment will see the construction of 45 new towers over the next five years, the placement of available "deployables" like Cell on Wheels (COWs) and Cell on Light Trucks (COLTs), 72 nationwide, 5 to be located in Oregon and Washington.

Other aspects of the FirstNet deployment will include developing in-building coverage solutions and leveraging state and federal agency assets to enhance network coverage and performance. "Band 14" frequencies, the frequencies that have been dedicated to public safety broadband communications, are currently being deployed on towers throughout the state.

It is anticipated that $40 billion will be invested in FirstNet over the 25 year contract with AT&T. Public Safety users represent about 5% of the national mobile wireless market.

More information about the First Responder Network Authority may be found at
www.firstnet.gov.
More information about FirstNet built with AT&T may be found at www.firstnet.com

FirstNet Competitive Responses
Sprint has also introduced Priority Connect services for first responders for public safety. Priority Connect provides priority access and preemption for voice and data, land mobile radio interoperability and a developing "ecosystem" of public safety solutions, including applications developed for school safety, and is doing so with aggressive pricing and free services. Sprint developed a service called Officer Down with utilizes a Kevlar vest that the instant an officer is shot or stabbed, opens a mic and calls for help also sending medical and location information.

Sprint will be introducing OneWeb for public safety, an innovative network using low orbit satellites with 30 to 50 milliseconds round trip latency and 400 Mbps transmission speeds creating hotspots for data communications.

Airlines will be among the first to deploy the system for in-air broadband on their planes. OneWeb will enable public safety communications without the end user device having to rely on local terrestrial network facilities for connectivity making it an excellent back-up solution for large scale disaster recovery applications.

Verizon has developed a comparable portfolio of services and capabilities.

Crisis Response Teams
- 24/7/365 team of Verizon employees
- National structure facilitated by calling one number for assistance
- Live support line contact
- Immediate field response based on requesting need for equipment and coverage using deployables.
- Assistance with subpoenas, search warrants & court ordered surveillance
- Response based upon geography

Crisis Response Teams utilize the following resources in a crisis:
- Ruggedized voice devices with wall & car charger
- 4G LTE Jetpacks & USB modems
- Enterprise grade 4G LTE routers with directional antenna solutions
- Charging stations with internet connected laptops
- 4G LTE internet connected tablets
- Personal onsite support for set up and during an incident
- Simplified return process for loaned equipment

Verizon essentially has its own proprietary bandwidth dedicated for public safety that has been in place for years providing traffic segmentation. This separates public safety communications traffic from commercial traffic. Priority and preemption are the two characteristics that drive traffic segmentation. Currently preemption is on data traffic only due to an FCC ruling that does

not allow preemption of voice traffic. Public safety customers have priority and preemption over other users according to assigned priority class. Mission critical push-to-talk capabilities will be available by the end of the year, and this feature will be interoperable with other carriers and with a gateway to Land Mobile Radio networks. Public safety applications are expanding such as smart personnel protection vests, and gunshot location.

Mobile Communications Trailer Deployable ($115,000 to $165,000)
- Portable, high-bandwidth satellite backhaul
- 4G-LTE Network Extender solution
- Can support 64 UEs providing up to 1500 feet of coverage. Servicing up to 200 customers
- Usage scenarios: FEMA trailers, fire camps, command centers
- Set up within one hour
- Compatible with voice and data devices

New features need to go through added authorization steps in Oregon to be added to the National Association of Procurement Officials (NASPO) contract.

Since the passage of the Middle-Class Tax Relief and Job Creation Act of 2012 that created the First Responder Network Authority, there has been a sea change in the public safety communications. And more broadly, the mobile wireless segment of the telecommunications industry is a key, if not the main driver of new infrastructure deployment.

911 Centers/PSAPs

Oregon's 911 Centers face significant challenges regarding broadband networks. 911 Centers continue to be in a transition period. The centers are largely operating with legacy systems, technology that has been in place for many years. These systems do not interface well or at all with the internet. Data, voice, radio, and computer-aided-dispatch communications are changing from analog to digital.

Many county dispatchers currently sit in front of multiple monitors for the internet access, for computer-aided-dispatch, for information sharing, and for phone system information. Each monitor is for access to separate systems that are not interconnected except for the human interface—the dispatcher.

Centers are attempting to move to Next Generation 911 under recommendations from the FCC, that require the capability to receive not only voice 911 calls, but also recommend receiving text, video, and images. As the public has moved to new technologies, such as mobile wireless and broadband, the nature of incoming requests for help have changed. To illustrate, about 70% of incoming 911 calls are now from cell phones without dispatch location information. A related issue in this environment is "pocket-dials" or unintentional calls from cell phones with no caller on the line. These can represent up to 35% of incoming calls, and the 911 centers are obligated to clear the calls and confirm that there is not an emergency.

Another ongoing change is the different security requirements for police and fire. Two factor authentications for police, and one for fire emergencies driving separated and "siloed" treatment for police and fire. When 911 calls are transferred to the Oregon State Police, often any data that

has previously been collected may be lost and the State Police dispatcher has to begin again with the caller. Current issues include the need to provide for text 911 contacts.

As incoming 9-1-1 calls are delivered to a 911 center, advancements in technology have rapidly outpaced compliance and standards setting organizations. These advancements reduce the ability to automatically obtain location information as was previously provided by landline calls with Caller ID information. Additionally, laws and regulation requiring the registration of locations behind PBXs or for VoIP systems have poor compliance. VoIP calls often have no reliable location information provided, and several VoIP service providers are not located in the United States, which results in 911 calls being sent to other countries. This requires callers to communicate their location to the center, which takes added time, and may not be accurate or effectively communicated.

A key issue of concern is funding and the ability of 911 centers to make necessary technological upgrades needed in this continually evolving communications environment. 911 centers already struggle with the fact that technology available to the public moves at a significantly quicker pace than that which is available to PSAPs. Once technological solutions are available to PSAPs, there is a lack of appropriated funding to ensure these necessary upgrades are completed. Some PSAPs within the state are entirely dependent upon state tax revenues to support the continuity of the 911 center, while others may have additional funding sources, however all 911 centers are in a position of having to compete for the limited funds that are available at the local level.

911 centers fall under the Oregon Office of Emergency Management. Public Safety Answering Points (PSAPs) are organized through the Association of Public-Safety Communications Officials (APCO) https://www.apcointl.org/.

Eight agencies in northwest Oregon and southwest Washington began non-integrated text-to-911 message service at the end of August 2016, though voice calls remain the preferred way for communications for emergency services. Text-to-911 service is now operational in Clackamas County, Lake Oswego, Portland Bureau of Emergency Communications for Multnomah County, Astoria 911 for much of Clatsop County, Columbia County, Washington County, and Marion Emergency Telecommunications, which covers northern Marion County around Woodburn. The service is not yet available state wide, according to Oregon Emergency Management. More information on these websites: www.nwtext911.info / www.wccca.com.

The U.S. Department of Commerce and the U.S. Department of Transportation announced final rules [2] for a grant program that will offer up to $110 million to help states, territories, tribal organizations, and the District of Columbia upgrade their 911 call centers to Next Generation (NG911) capabilities.

Today, 70% of all 911 calls are placed from wireless phones, but most 911 call centers rely on decades-old networks capable of carrying only voice calls and limited amounts of data. The call centers have not kept pace with advances in consumer technology, and as a result cannot support callers who wish to send text messages, images, video, and other communications that utilize large amounts of data.

NG911 enables 911 calls to contain digital information such as photographs and video. The technology will improve coordination among the nation's 911 call centers, dynamically re-route calls based on location and call congestion, and connect first responders to key health and government services in the event of an emergency.

In 2009, the Department of Commerce's National Telecommunications and Information Administration and Department of Transportation's National Highway Traffic Safety Administration oversaw more than $40 million in grants through the ENHANCE-911 (E911) Grant Program. The Next Generation 911 Advancement Act of 2012 provided new funds for the program and broadened the eligible uses of those funds. These new uses include adoption and operation of NG911 services and applications; the implementation of IP-enabled emergency services and applications enabled by NG911 services; the establishment of IP backbone networks; and training of public safety personnel in 911 services.
https://www.ntia.doc.gov/press-release/2018/us-department-commerce-us-department-transportation-issue-final-rules-110-million

The Next Generation 911 challenge is likely be long term. In October 2018, The National Telecommunications and Information Administration and the National Highway Traffic Safety Administration issued a report to Congress stating that a national upgrade to a next generation 911 system would cost between $9.5 billion and $12.7 billion and take at least 10 years to complete. In addition to implementation costs outlined in the report, the office identified an ongoing operational and technology refresh cost ranging between $13.5 billion and $16 billion.
https://statescoop.com/federal-report-prices-national-next-generation-911-rollout

Agriculture

Agriculture, which contributes more than $8.25 billion to Oregon's economy each year, is emerging as an important driver and application for broadband infrastructure in rural areas of the state.

Farming and agricultural production has been the basis of civilization for thousands of years. The world population continues to grow and farmers are being asked to produce more food on the same land while balancing our environmental health. Farmers know their land well and how to work it to get the most out of it, but this knowledge is often at the level of a field or large acreage plot. One goal of precision agriculture is the use of technology to decrease this resolution down to a square foot. For example, experience tells the farmer that field A takes about 10 yards of x to improve crop production and it's is uniformly distributed. However, this square foot of field doesn't need any of x, but 10 feet away it needs extra. This level of precision requires computers to store and process sensor data to supply workers and or automated systems. A traditional model of computing is to buy a computer, install your software and start using it. This model doesn't work well with the amount of data that can be generated, the processing power to crunch it and the speed of change based on additional or new information. This is the power of the "cloud." But the information super-highway to connect the cloud with those seeking to use it doesn't often stretch into rural communities or it looks like a gravel road instead of a 4-lane highway as it often looks to those in metro areas. This lack of high-speed infrastructure in rural communities is the main barrier for farmers to adopt new technologies and equipment. This lack of access

typically results in status-quo practices which are less efficient and result in ripple effects leading to higher food costs and potentially unnecessary environmental impacts.

There has been a steadily increasing use of the internet and computers by Oregon farmers but there is also a significant lag in the use of these resources for the farm business. This leads to the conclusion that these tools are used for typical tasks of electronic communication and online research. This is all that is possible using the low bandwidth typically associated with the common methods of internet access. In order for Oregon farmers to begin the adoption of technology to increase yields and reduce environmental impacts, they must have ubiquitous higher-bandwidth internet access to stream sensor data to the cloud where the storage and processing power exists to support decision support algorithms and systems. These existing internet-based systems can help farmers today to lower their environmental impact and increase yields with even further promises down the road using robotics and other automated systems, but access is reliant upon high-bandwidth internet access where our food is grown, rural Oregon.

Oregon's rich culture of innovation has resulted in 200+ commodities grown around the state. This kind of diversity makes it hard to station key technological support systems, which are typically domain or commodity specific, at strategic locations around the state because 200+ commodities need 200+ different sets of tools to be successful. This further supports the need for broadband coverage across ALL of Oregon.

The number of US farmers using the Internet of things (IoT) is now estimated at 250,000, with a potential future market size of $4 billion, according to researchers at Alpha Brown. The IoT is pioneering tools for farmers, including smart sensors, applications, and systems that save time, money, and energy. For example, IoT applications can conserve as much as 90% of irrigation water and reduce chemical use by 30 to 50%, according to Ipsos Business Consulting. The use of modern telecommunications in agriculture paints an optimistic picture of the industry's future, all thanks to broadband providers who have created a platform for innovation and connectivity. http://www.telecompetitor.com/report-u-s-agricultural-iot-market-could-be-4-billion-250k-farmers-using-iot-today/

Some of the state's largest data capacity customers in rural areas are in agriculture. The agriculture sector is a huge consumer of technology with increasing needs for bandwidth and access in rural agricultural areas. The average farm size in Umatilla County is five thousand acres. New combines are high tech pieces of equipment, often autonomous, and generate terabytes of data.

In similar fashion, forestry is increasing high tech using sensors and smart devices collecting and need to transport large amounts of data for the study of forests and the management of forest lands. OSU has fifty offices statewide with extension services, fourteen agricultural experiment stations.

The agricultural industry is expecting big things from smart farm technology aimed at enhancing crop yields while minimizing the use of fertilizers, pesticides, and water and which will rely heavily on broadband connectivity. According to Transparency Market Research, the global

smart agriculture market is expected to increase 13.5% annually through 2025, rising from $6.5 billion in 2015 to $23.4 billion by 2025. But how widely the technology is adopted will depend, in large part, on the availability of mobile broadband connectivity to support it. Smart farm technology includes equipment that can be precisely controlled through built-in global positioning system (GPS) capability, as well as equipment designed to assist farmers with decision making … Decision making capabilities are enabled through sensors built into farm equipment to collect a wide range of data about soil, crop yields and other parameters that can be used to make decisions about what, when and where to plant specific crops, as well as decisions about fertilizer and pesticides. Smart farm technology requires LTE speeds at a minimum. Depending how farmers use smart farm technology, a high-speed fixed broadband connection from the farm to the internet also could be critical. Yet, as AEM noted, 39% of rural Americans in 2016 lacked broadband connectivity at speeds of 25 Mbps downstream and 3 Mbps upstream, compared with only 4% in urban areas.

http://www.telecompetitor.com/with-smart-farm-technology-individual-plants-now-generate-data-requiring-good-rural-broadband-coverage

Agriculture will become the largest driver for broadband infrastructure deployment in rural areas of the state. Precision agriculture requires reliable broadband connectivity to farmers in the field to be effective. Deere & Company (John Deere) believes that precision agricultural practices in use today are laying the foundation for the future of farming: a continually smart, evolving and more efficient farm. Key technologies advancing this future include Artificial Intelligence, or AI, and Machine Learning. Deere is developing and utilizing technology and solutions almost all of which are digital in nature and internet-based [John C. May, President Ag Solutions and Chief Information Officer Deere & Company].

OBAC member and Oregon PUC Commissioner Stephen Bloom sits on the National Association of Regulator Utility Commissions (NARUC) Telecom Committee and is a sponsor of that organization's resolution to encourage Congress to pass the "precision Agriculture Connectivity Act of 2018. NARUC views the deployment of broadband internet access service to unserved agricultural land is critical to the United States economy and to the continued leadership of the United States in global food production.

Local Community Broadband Planning

The need for broadband planning is compelling. Strategic Networks Group www.sngroup.com, an economics consultancy, make the case for broadband as essential infrastructure. SNG's research indicates that ubiquitous affordable broadband access at a minimum of 25 Mbps downstream and 3 Mbps upstream is necessary if a community is to be able to improve local business competitiveness, innovation, growth, and to ultimately survive in an information based global digital economy. Broadband availability and utilization produces increased revenues and jobs. Broadband enables businesses to be more competitive, creates a demand for high-skilled workers, and grows markets and revenues for service providers. Many of the greatest benefits for communities are off-balance sheet for the service providers, which is why local community leaders and government need to engage to help drive the case for broadband deployment. And those benefits increase with rates of utilization.

Planning templates and resources have been developed under the Oregon Broadband Outreach and Strategic Planning Project and are available at: www.oregonbroadbandplanning.org.

Federal Funding Programs

The FCC released an order adopted last week detailing plans to make an additional $540 million available to rural telecom providers to help cover the costs of deploying broadband to areas that are costly to serve and where minimum-speed broadband is not available. The FCC also detailed adjustments that will be made to how carriers receiving funding will be reimbursed, including the types of costs that can be recovered through the Universal Service Fund (USF) program. http://www.telecompetitor.com/fcc-authorizes-an-additional-540-million-for-usf-rural-broadband-funding

The omnibus spending bill passed earlier this year will provide USDA with $600 million to fund rural broadband grants (AgWeb). The omnibus spending bill will provide USDA with $600 million to fund rural broadband grants. According to the Federal Communications Commission, 80% of the 24 million American households that do not have reliable, affordable high-speed internet are in rural areas. https://www.agprofessional.com/article/omnibus-spending-bill-gives-usda-600-million-rural-broadband

The U.S. Department of Agriculture Rural Development continues to have a suite of broadband funding programs that focuses on rural broadband development.
- Distance Learning Telecommunication Grant Program

This program helps rural communities use the unique capabilities of telecommunications to connect to each other and to the world, overcoming the effects of remoteness and low population density. https://www.rd.usda.gov/programs-services/distance-learning-telemedicine-grants
- Community Connect Program

This program funds broadband deployment into rural communities where it is not yet economically viable for private sector providers to deliver service. https://www.rd.usda.gov/programs-services/community-connect-grants
- Rural Economic Development Loan and Grant ("RED Light") Program provides funding for rural projects through local utility organizations. USDA provides zero-interest loans to local utilities which they, in turn, pass through to local businesses (ultimate recipients) for projects that will create and retain employment in rural areas. Up to $2 million in 0 interest loan funding may be provided. https://www.rd.usda.gov/programs-services/rural-economic-development-loan-grant-program
- The $600 million Rural Broadband Pilot Program funded by the recent Omnibus Bill which is currently being developed, and will be introduced later this year.
- Information on all the USDA telecom programs may be found at https://www.rd.usda.gov/programs-services/all-programs/telecom-programs

In July, the Federal Communications Commission announced its plan to establish a new $100 million Connected Care Pilot Program to support low-income Americans with emphasis on rural areas and on veterans.

Oregon needs to work to raise its level in the internet hierarchy. The internet is not a single managed network but is rather a network of networks requiring that data traffic needs to be passed between one or more networks at points of interconnection to move from sender to receiver. These peering points of interconnection between the largest networks (Tier 1 networks) exist in locations around the U. S. and the world, none of which are in Oregon. Peering interconnection does take place in Oregon between networks, and the non-profit corporation NWAX has grown to provide a point of local peering for about eight networks in the state.

Network Interconnection

Oregon should pursue the following interconnection goals.
- Encourage all the major CDNs to locate physical facilities (PoPs) in Oregon for interconnection
- Focus on direct interconnection for cloud computing applications
- Get Tier 1 networks to peer in and place PoPs in Oregon (Google, Facebook, and Apple don't interconnect with Tier 1 networks in Oregon today).
- Strategically leverage the growing number of undersea cables coming ashore and the resulting data traffic that is passing through Oregon.
- Get large data centers in Oregon to join the Oregon ecosystem
- Maximize all levels of interconnection that take place in Oregon.
- Make it easy to interconnect in Oregon.
  - Document available assets
  - Promote Oregon to targeted carrier networks, undersea cable operators, CDNs, cloud computing providers
  - Develop incentives
  - Leverage NWAX (Grow to 100 peers) (14th largest Exchange in the nation located in the 23rd largest Metropolitan Statistical Area)

The continuing challenge is that Oregon has limited number of locations with critical density, like Portland and Hillsboro, to drive interconnection. Despite that challenge, long term plans should consider locations in the eastern part of the state for interconnection, physical diversity and resilience. The growing number undersea fiber cables landing in Oregon with logarithmically growing data traffic should be leveraged.

The value proposition for Oregon and the Oregon economy is the network. Increasingly, the economy is the internet and people in the internet economy. Fortunately, excellent network infrastructure and companies in this economy like Google, Amazon, and Facebook have already invested in Oregon and help drive that for the state.

Recommendations

The Oregon Broadband Advisory Council makes the following recommendations.

Create an Oregon Broadband Office

A dedicated state government office can be a tool for creating connections and sharing information among state agencies, broadband service providers, and other stakeholders. Whether as an independent agency, within a state agency, or in the Office of the Governor, the broadband office's responsibilities should include:

- Developing and recommending broadband policies at the local and state levels that work with but do not pre-empt local government authority in areas of broadband deployment or adoption.
- Being a source of current information about broadband infrastructure and digital inclusion, best practices, and lessons learned.
- Supporting other state agencies' efforts to increase broadband access (to homes, businesses, and community anchor institutions).
- Supporting other state agencies' efforts to increase digital literacy.
- Championing commercial access to state-owned and managed assets.
- Connecting communities working toward similar broadband-related goals or facing similar challenges.
- Forecast demand and set long term goals for sustainable service in partnership with industry.
- Responding to consumer calls regarding broadband access and helping coordinate and navigate federal and state funding sources.

http://pellcenter.org/wp-content/uploads/2015/09/State-Level-Broadband-Policy-FINAL.pdf

Provide State Funding

Develop and fund new grant, loan and loan guarantee programs for broadband infrastructure in unserved areas and as matching funds for other funding sources.

- Leverage federal funding programs through state funding match and technical assistance for eligible Oregon applicants.
- Upgrade state and local government telecommunications networks as a means to expand broadband service to unserved or underserved areas.
- Repurpose the Oregon Universal Service Fund to improve broadband infrastructure in unserved and underserved areas.
- Consider state funding to subsidize broadband costs for low adoption populations and community anchor institutions similar to the FCC's E-rate Program, Healthcare Connect Fund, and Lifeline Program.
- Require that broadband infrastructure components such as conduit be included for all state infrastructure funding programs such as roads, bridges, water, and wastewater projects.

Reduce barriers to adoption

- Provide outreach to low-adoption populations through established community institutions.
- Increase the availability of affordable broadband services.
- Increase access to user devices.
- Work with service providers to offer, leverage and promote low-income subsidy/discount programs.
- Promote digital literacy:
  - Focus on building digital skills education and digital literacy in the K-20 school system.

- Focus on building digital skills education and digital literacy through workforce training and outreach to low adopters including low-income groups, low-education groups, and seniors.
- Educate organizations on how to use broadband technologies to pursue their mission and achieve their goals.
- Educate communities on how to use broadband technologies for economic and community development.

Reduce barriers to broadband infrastructure deployment
Encourage, facilitate and incent private sector investment in broadband infrastructure. Encourage competition. Aggregate demand and reduce regulatory barriers to improve the private sector business case.

Adopt Dig Once policies that mitigate a high cost component of buried cable infrastructure by requiring ample time interval notification of open trench construction projects and in some cases requiring placement of conduit within the public right of way for future use in deploying optic fiber network systems. Incorporate broadband into all new construction projects including buildings and housing developments. The city of Sandy as a municipality already requires that new housing developments and other new construction projects include the placement of telecommunications conduit.

Evaluate policies governing access to public rights-of-way, pole attachments, duct access, facilities siting, and public vertical assets such as towers and buildings can impact broadband network deployment. In 2013, the Federal Highway Administration estimated that 90 percent of the cost of burying broadband infrastructure along a roadway consists of the expense of digging up and replacing disturbed land and the road. The National Broadband Plan found that an effective rights-of-way policy of facilitating joint placement of facilities through "dig once" policies can reduce broadband deployment costs by more than 20 percent.
https://www.fhwa.dot.gov/policy/otps/policy_brief_dig_once.pdf

Require that broadband infrastructure components such as conduit be included for all state funded infrastructure programs including roads, bridges, water, and wastewater projects.

Governments are the largest owners of property in the nation. In 2015, the Broadband Opportunity Council recommended that the Federal Government create an "open data inventory of infrastructure assets" for broadband to enable the private sector to more easily identify and access public assets for broadband infrastructure placement. Create this inventory for Oregon.

Remain technology and provider neutral
A frequent misstep in broadband public policy development is to specify technologies. Public policy should focus on user needs and desired outcomes, and not on the specific technological solutions to meet them.

Concluding Remarks

OBAC has frequently observed and reported that broadband is a moving target and that broadband infrastructure will always be a work in progress. This is critical for our assessment of Broadband in Oregon. The FCC's current benchmark for broadband is 25 Mbps down and 3 Mbps up (25/3) and that bar is expected to be raised sometime in the future due to improved technologies, new applications and increasing end-user demand. This means that the digital divide not only continues to exist but will grow without new and continued investment in broadband infrastructure. This means that Oregon communities that do not have access to broadband services at 25/3 today, and higher level standards tomorrow, are not sufficiently served to support education, to support growing telehealth and telemedicine applications, to support energy management, to support the Internet of Things, to support the creation of new businesses, to recruit new businesses, to support economic growth or to be competitive.

According to a recent FCC Universal Service Monitoring Report, 84.9% of Oregonians subscribe to "high-speed internet" in the home, 66% subscribe to service at 10/1, 58% have access to service at 25/3, and 17% have access to services at 100/10 Mbps. At once, we can be proud that Oregon has higher broadband access, adoption and utilization rates than most other states, but we also need to be aware that this is not enough. We may be ahead of many now, but we need to stay engaged to keep up with changing technologies, markets and user demand. We have achieved much progress but have more work to do. Oregon's broadband public policy needs to be focused on the future, be more aggressive, be more financially supportive, be more specific, and needs to have a renewed sense of urgency.

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She Flies With Her Own Wings.
—Oregon State Moto

</div>

Appendices

Appendix A

What is Broadband?

Broadband is a general term used to represent a wide range of telecommunications technologies and services which utilize a faster data transmission rate than that available over the standard voice grade telephone line, which is 56 Kbps and usually less. Broadband is also widely referred to as "high-speed" internet access service.

Until 2008, the FCC's official definition of broadband was a transport service offering a minimum data transmission rate of 200 Kbps in one direction. That year, the FCC established a set of Broadband Tiers:

Tier	Rate
1	200 Kbps up to 768 Kbps
2	768 Kbps to 1.5 Mbps
3	1.5 Mbps to < 3.0 Mbps
4	3.0 Mbps to < 6.0 Mbps
5	6.0 Mbps to < 10.0 Mbps
6	10.0 Mbps to < 25.0 Mbps
7	25.0 Mbps but < 100.0 Mbps
8	100.0 Mbps and beyond

FCC Broadband Service Speed Tiers

Tier 1 is characterized as "First Generation Data." 768 Kbps is now the minimum data transmission rate for "Basic Broadband." Tiers 3 through 8 reflect the range of service speeds available and expected to become available from providers.

In its National Broadband Plan, the FCC proposed a goal that every household and business location in America should have access to affordable broadband service with actual download speeds of at least 4 million bits per second (Mbps) and actual upload speeds of at least 1 Mbps with the further recommendation that the FCC review and reset this target every four years. On January 29, 2015, the FCC raised the benchmark for broadband from 4 megabits per second (Mbps) down and 1 Mbps up to 25 Mbps down and 3 Mbps up, and it will be raised again.

Many different technologies are employed to deliver broadband services in Oregon including Digital Subscriber Line (DSL), Cable-Modem, wireless (mobile 3G/4G, 5G, fixed, satellite), and optic fiber to the premises (FTTP). These service technologies range in transmission performance from 200 Kbps up to 1 billion bits per second (Gigabits per second) and beyond.

Broadband services in Oregon are available from a wide mix of service providers including telephone companies, cable companies, competitive access providers, fixed and mobile wireless providers, municipal and consortia providers, and satellite service providers.

Appendix B

Survey of Oregon's Electric Utilities

Name of Utility:_____

Report Completed By:_____

Excluding administrative/office internet, please provide the range of speeds your utility uses in your utility operations in Mbps.

Does your utility receive broadband service from a third party(s) or self or a combination?

1) How are your broadband services received? Check all that apply.
   - a.   Fiber
   - b.   Cable
   - c.   Fixed wireless
   - d.   Cellular
   - e.   DSL
   - f.   Other

2) What type of broadband services do you receive? Check all that apply.
   - a.   Internet
   - b.   Ethernet
   - c.   3G Cellular
   - d.   4G/LTE Cellular
   - e.   Other

3) What do you use broadband services for? Check all that apply.
   - a.   Advanced Metering Infrastructure (AMI) (two-way) (smart meters)
   - b.   Automatic Meter Reading (AMR) (one-way)
   - c.   Supervisory Control and Data Acquisition (SCADA)
   - d.   Distribution Automation (DA)
   - e.   Off Site Data Storage
   - f.   Computer in Vehicles
   - g.   Other

4) If you receive service from a third party, do you plan to replace it in the future with your own infrastructure? If so, when?

5) Please identify which of the functions you use broadband to support. Please provide this information by placing either a **'Y' or 'N' or 'Maybe' on each line in the table below. Where you answered N, please identify any barriers you see to implementing this function.**

Function	Current– Y or N	In the future– Y, N, or Maybe	Barrier/Comment
Load Interruption (e.g. direct load control)			
Advanced Metering Infrastructure (AMI)			
Distribution Automation (e.g. fault detection and recovery)			
SCADA			
Customer Prepay			
Outage Management			
Energy Monitoring by Customer			
Voltage Reduction			
Demand Bidding and Buyback			
Time-of-Use Rates			
Other (describe)			

Appendix C

Oregon Broadband Advisory Council Members—2018

The mission of the council is to encourage coordination and collaboration between organizations and economic sectors to leverage the development and utilization of broadband for education, workforce development, government and healthcare, and to promote broadband adoption by residents and communities. The council members represent Oregon's cities, counties, telecommunications service providers, tribes, educators, economic development organizations, public safety agencies, healthcare providers, E-Government, the Public Utility Commission, the State House of Representatives and the State Senate. Members of the council were appointed by the Governor, the Speaker of the House, and the President of the Senate.

Council Members

Stephen Bloom
Commissioner
Public Utility Commission of Oregon

Anne Carloss
Director of Special Education
Hood River County School District

Miles Ellenby
Associate Professor of Pediatric Critical Care Medicine
Medical Director, Telemedicine Program
Doernbecher Children's Hospital / Oregon Health and Science University

Joseph Franell **(Council Chair)**
General Manager and CEO
Eastern Oregon Telecom

Wade Holmes
Vice President of Technology
BendBroadband

Lonny Macy
Community and Economic Development Planner
Confederated Tribes of Warm Springs

Pam Marsh
Representative
Oregon House of Representatives

Jeremy Pietzold **(Council Vice-Chair)**
City Council President
City of Sandy

Dave Sabala
Economic Development

Vacant
Senator
Oregon State Senate

Melody Riley-Ralphs
Chief Technology Officer
Office of the State Chief Information Officer (OSCIO)

Michael Weidman (Resigned 2018, seat now vacant)
Former President and CEO
LS Networks, Inc.

Tom Worthy
Major
Oregon State Police

David Yamamoto
Commissioner
Tillamook County

Staff:
Christopher Tamarin
Telecommunications Strategist
Business Oregon
121 SW Salmon Street, Suite 205
Portland, Oregon 97204
503 508-0178 Phone/Cell
503 581-5115 Fax
christopher.tamarin@oregon.gov

Council website: www.broadband-oregon.org

Appendix D

Oregon Broadband Advisory Council Activity Summary 2010-2018

The Oregon Broadband Advisory Council (OBAC) was created in the 2009 Legislative session to help ensure the implementation of statewide broadband strategies. The mission of the council is to encourage coordination and collaboration between organizations and economic sectors to leverage the development and utilization of broadband for education, workforce development and telehealth, and to promote broadband utilization by residents and communities. The council members represent Oregon's cities, counties, telecommunications service providers, Tribes, educators, economic development organizations, public safety agencies, healthcare providers, e-government experts, the Public Utility Commission, the State House of Representatives and the State Senate.

OBAC began meeting in January 2010. In 2015, the Oregon Legislative Assembly passed, and Governor Kate Brown signed a bill to extend the council's sunset date to January 1, 2020. As of November 1, 2018, the council has convened xx times to discuss, deliberate, and report on broadband issues, economics, technologies, and public policy as they relate to the interests of Oregonians. OBAC presenters (in chronological order) are listed below, and OBAC meeting attendees have represented the organizations listed below.

The council prepared and submitted *Broadband in Oregon* reports to the Legislative Assembly and the Governor in November 2010, 2012, 2014, 2016, and 2018. It also produced the *Gas & Electric Utilities Broadband Deployment Report* in 2012 and *Broadband Outreach Survey Report* in 2014.

OBAC participated several State Broadband Data and Development Program grant projects administered by the National Telecommunications and Information Administration and the Oregon Public Utility Commission.
- OBAC participated in the Oregon Broadband Mapping Project and the 2010 Oregon Broadband Adoption Survey
- OBAC was a grant sub-recipient and directly supervised the Oregon Broadband Outreach and Strategic Planning Project and the 2014 Oregon Broadband Adoption Survey.

OBAC presenters (in chronological order) have included:

2010
Rep. Jefferson Smith
Ray Baum, Oregon Public Utility Commission
Roger White, Oregon Public Utility Commission
Dawn Bonder, Oregon Health Information Technology Oversight Council
Milo Mecham, Lane Council of Governments
Barbara Young, CenturyTel
Frank Miller, BendBroadband
Michael Weidman, LS Networks
Brant Wolf, Oregon Telecommunications Association

Fred Ziari, EZ Wireless / IRZ Consulting / OnSmart Technologies
Doug Cooley, Comcast
Phil Garrett, MINET
Mike Dewey, Oregon Cable Telecommunications Association
Judy Peppler, Qwest
Vicki Walker, U.S. Department of Agriculture Rural Development
Joe Bradley, U.S. Department of Agriculture Rural Development
Scott Lazenby, City of Sandy
Dudley Slater, Integra Telecom
Cobi Jackson, One-Economy Corporation
Eddie Choi, One-Economy Corporation
Rebecca Yalch, Opinion Research Corporation
Bryan Conway, Oregon Public Utility Commission
Adam Grzybicki, AT&T Wireless
Mary Beth Henry, City of Portland

2011

Renee Willer, Frontier Communications
Rich Bader, Easystreet Online Services
Eric Schmidt, Association of Oregon Counties
Michael Lainoff, Lane Community College / Small Business Development Center Network
Mark Gregory, Lane Community College / Small Business Development Center Network
Doug Cooley, Comcast
Steve Noel, Oregon Department of Transportation / Oregon Wireless Interoperability Network
Andrea Crosby, Citizens Utility Board
Rebecca Yalch, Opinion Research Corporation
Cobi Jackson, One-Economy Corporation
Brant Wolf, Oregon Telecommunications Association
Sean McSpaden, Oregon Department of Administrative Services
Wally Rogers, Oregon Department of Administrative Services
Bill Casale, iLinc
Heather Burks, Oregon Department of Administrative Services
Roger White, Oregon Public Utility Commission
Carla Wade, Oregon Department of Education
Mary Beth Henry, City of Portland
Kristi Wilde, Oregon State Interoperability Executive Council (SIEC)
Kim Lamb, Oregon Health Network
Rebekah Dohrman, League of Oregon Cities
Carol Robinson, Oregon Health Information Oversight Council
Doug Cooley, Comcast
Jeff Nicol, Gorge Technology Alliance
Tom Potiowsky, Portland State University
Marilyn Harbur, Oregon Department of Justice
Linda Blacklock, Oregon Department of Justice
Rebecca Yalch, ORC International

2012

Shelley Jones, Oregon Public Utility Commission
John Horvick, Davis Hibbitts and Midghall, Inc.
Tom Lauer, Oregon Department of Transportation
Paul Baldwin, Fortune Data Centers
Brant Wolf, Oregon Telecommunications Association
Barbara Young, CenturyTel
Michael Lainoff, Lane Community College / Small Business Development Center Network
Mark Gregory, Lane Community College / Small Business Development Center Network
Carla Wade, Oregon Department of Education
Steve Noel, Oregon Department of Transportation / FirstNet
Albert Gauthier, Oregon State Police
Steve Viotolo, Oregon Department of Transportation
Renee Willer, Frontier Communications
Peter Trnavskis, Oregon Health Network
Dr. Miles Ellenby, Oregon Health & Science University/ Doernbecher Children's Hospital
Michael Seelig, Oregon Education Investment Board
Will Saunders, Washington State Department of Commerce
Ed Arabas, Oregon Department of Administrative Services
Philip Woods, Oregon Department of Administrative Services

2013

Zach Holander, NetCity Inc.
Michael Lainoff, Lane Community College / Small Business Development Center Network
Laura Cleland, Association of Oregon Counties
Carla Wade, Oregon Department of Education
Amy McLaughlin, Oregon Department of Education
Michael Seelig, Oregon Education Investment Board
MaryKay Dahlgreen, Oregon State Library
Steve Noel, Oregon Department of Transportation / FirstNet
Brant Wolf, Oregon Telecommunications Association
David Bell, Fibersphere
Rock Rakosi, Myrtle Point Police Department / SIEC
Nancy Jesuale, NetCity Inc.
Yumei Wang, Oregon Department of Geology and Mineral Industries
Michael Curri, Strategic Networks Group
Craig Settles, Gigabit Nation
Vicki Walker, U.S. Department of Agriculture Rural Development

2014

Steve Noel, Oregon Department of Transportation / FirstNet
Neil Grubb, Freewire Broadband
Shawn Irvine, City of Independence
Don Patten, MINET
Ben Tate, Oregon Department of Education
Gillien Duvall, Oregon Office of Emergency Management

Bob Duehmig, Telehealth Alliance of Oregon
Cathy Britain, Telehealth Alliance of Oregon
Rick Williams, Leidos
Steve Boespflug, Pivot Group
Dave Nieuwstraten, Pivot Group
Laura McKinney, Oregon University System
David Childers, Compli
Ann Steeves, Portland General Electric
Dave Sabala, Douglas Electric Cooperative

2015
Laura McKinney, Oregon University System
David Childers, Oregon Engineering Technology Industry Council (ETIC)
Carla Wade, Oregon Department of Education
Sidra Metzger-Hines, Oregon Office of Emergency Management
Terry Knight, Federal Emergency Management Agency (FEMA)
Dan Runcie, Education Super Highway
Cheryl Bledsoe, Clackamas County 911 Center
Amy McLaughlin, Oregon Department of Education
Rob Kaye, Providence Health & Services
Steve Noel, FirstNet
Cheryl Hiemstra, Oregon Department of Justice
Bob Duehmig, Telehealth Alliance of Oregon
Monica Koiv, OCHIN
Courtney Stennick, OCHIN
John Windhausen, Schools, Health and Libraries Broadband Coalition (SHLB)
Galen McGill, Oregon Department of Transportation
David Soloos, Office of the Oregon CIO
Thompson Morrison, Innovate Oregon
Dana Shaffer, Federal Communications Commission (FCC)
Craig Settles, Gigabit Nation
Bruce Roton, Level(3) Communications
Theresa Masse, Port of Portland
Matt Modarelli, State of Washington
Program Coordinator (name withheld by request), Federal Bureau of Investigation (FBI)

2016 (through October 19)
Mark Tennyson, Oregon Office of Emergency Management
Steve Noel, FirstNet
Brant Wolf, Oregon Telecommunications Association
Amy McLaughlin, Oregon Department of Education
Shawn Irvine, City of Independence
Cheryl Hiemstra, Oregon Department of Justice
Barb Young, CenturyLink
Karen Stewart, CenturyLink
David Trepp, Info@Risk Inc.

Wade Holmes, BendBroadband
Carla Wade, State Educational Technology Directors Association
Meredith Guardino, Oregon Office of Rural Health
Don Bonker and Kristin Harrison, Portland Metro STEM Partnership
Mary Beth Henry, City of Portland
Thompson Morrison, Innovate Oregon
Kathy Tate, OnlineNW
Debbie Moller, Oregon Office of Emergency Management
Vanessa McLaughlin, Welcome Home Health
Eric Rosenberry, Northwest Access Exchange (NWAX)
Kirk Lee, Frontier Communications
Susie Strangfield, Oregon Department of Education
John Webber, Allion USA
Craig Settles, Gigabit Nation
Mike Wells, Oregon Department of Justice
Michael Curri, Strategic Networks Group

2017
Michael Curri, Strategic Networks Group
Mike Wells, Oregon Department of Justice
Tom Gurr, Pacific Technology Alliance
Susie Strangfield, Oregon Department of Education
Carla Wade, Oregon Department of Education
David Soloos, Office of the State Chief Information Officer
Matt Sayre, Technology Association of Oregon
Steve Noel, First Responder Network Authority
Wade Holmes, BendBroadband
Nick Green, City of John Day
Jordan McDonald, Wtechlink
Jeff Crews, Eastern Oregon Net, Inc. (EONI)
Jeff Christiansen, Entry Point Networks
Amy McLaughlin, Oregon State University
Tim Downs, SmallCellSite.com
Eric Rosenberry, Northwest Access Exchange (NWAX)
Jill Miles, Business Oregon
Stuart Taubman, Zayo Group
Craig Fidler, Wave Broadband
Julie Omelchuck, City of Portland
Rebecca Gibbons, City of Portland
Jeff Gavlinski, Ex^2 Technology, LLC
Steve Hill, Satellite Broadcasting & Communications Association
Andrew Plato, Oregon Cybersecurity Advisory Council

2018 (January - October)
Steve Noel, First Responder Network Authority
Melissa Sassi, Microsoft

Richard Roche, AT&T
Ken Lyons, AT&T
Michael Curri, Strategic Networks Group
Angela Siefer, National Digital Inclusion Alliance
Michael Elford, CenturyLink
John Huffman, U.S. Department of Agriculture
Jon Dolan, Oregon State University
Melody Riley-Ralphs, State of Oregon, Office of the State Chief Information Officer
Carl Erhart, Frontier Communications
Carla Montrose, Sprint
Brian Mancuso, Sprint
Thomas Tran, Sprint
Rick Woidyla, Verizon Wireless
Robert Fletcher, Verizon Wireless
Stuart Taubman, Zayo Group
John Talbot, Oregon State University Extension Service
Brant Wolf, Oregon Telecommunications Association
Jonathan Chambers, Conexon
Jim Teece and Todd Way, Northwest Telecommunications Association (NWTA)

OBAC meeting attendees have represented:

ADP Resources	City of Sandy
Allion USA	City of Springfield
Ashland Home Net	CJSpeaks/Gigabit Nation
Association of Oregon Counties	Clackamas Community College
AT&T	Clackamas County
AT&T Wireless	Clackamas County 911 Center
Azimuth Communications	Clackamas ESD
Beaverton Schools	Comcast
BendBroadband	Compli
Black Mountain Consulting	ComSpan USA
BroadMap	Comstructure Consulting
Central Lane 911	Connexon
CenturyLink	Converge Communications
CenturyTel	Dale Hines Consulting
Charter Communications	DAS-CIO-Economic Recovery Exec. Team
Citizens' Utility Board	Davis, Hibbits & Midghall, Inc.
City of Corvallis	Day Wireless
City of Eugene	Douglas Electric Cooperative
City of Gladstone	Douglas FastNet
City of Independence	Eastern Oregon Net, Inc. (EONI)
City of John Day	EasyStreet Online Services
City of Milwaukie	Education Super Highway
City of Oregon City	Electric Lightwave
City of Portland	Entry Point Networks

Ex2 Technology
EZ Wireless
Federal Bureau of Investigation (FBI)
Federal Communications Commission
Federal Emergency Management Agency (FEMA)
Fibersphere
FirstNet
First Responder Network Authority
Fortune Data Centers
Freewire Broadband
Frontier Communications
Gardner & Gardner
Gigabit Nation
GorgeNet
Gorge Technology Alliance
Government Camp Communications
Greater Eastern Oregon Development Corp.
Greenwire Broadband
Hermiston School District
High Desert ESD
Hood River County School District
Hunter Communications
iLinc
Individuals representing themselves
Info@Risk, Inc.
Innovate Oregon
Integra Telecom
Intel
Intermountain ESD
IRZ Consulting
J. Irwin Consulting
Keenwire
Lake County
Lane Community College / Oregon Small Business Development Center Network
Lane Council of Governments
League of Oregon Cities
Level(3) Communications
LS Networks
Marion County
Microsoft
Mid-Columbia Economic Development District (MCEDD)
MiddleGate

MINET
Motorola
Mt. Hood Cable Regulatory Commission & Office for Community Technology
Multnomah ESD
NetCity, Inc.,
National Digital Inclusion Alliance
Northwest Access Exchange (NWAX)
Northwest Telecommunications Association
NOKIA
NWAX
Occam Advisors
OCHIN
Office of the Oregon Attorney General
Office of Governor Kate Brown
Opinion Research Corporation
ORC International
Oregon Business Development Department
Oregon Cable Telecommunications Assoc.
Oregon Connections Academy
Oregon Council of Presidents
Oregon Cybersecurity Advisory Council
Oregon Department of Administrative Services
Oregon Department of Education
Oregon Department of Geology and Mineral Industries
Oregon Department of Revenue
Oregon Department of Transportation
Oregon Economic Recovery Executive Team
Oregon Engineering Technology Industry Council (ETIC)
Oregon Education Investment Board
Oregon Governor's Office
Oregon Health Information Technology Oversight Council
Oregon Health and Science University
Oregon Health Network
Oregon Legislative Assembly
Oregon Legislative Fiscal Office
Oregon Legislative Policy and Research Office
Oregon Municipal Electric Utilities Association

Oregon Office of Emergency Management
Oregon Office of Rural Health
Oregon Office of the State CIO
Oregon Public Utility Commission
Oregon Department of Administrative Services
Oregon Department of Justice
Office of the Oregon CIO
Oregon Department of Justice
Oregon Department of Transportation
Oregon State Interoperability Exec. Council
Oregon Office of Emergency Management
Oregon State Library
Oregon State Police
Oregon State University
Oregon Telecommunications Association
Oregon University System
One-Economy Corporation
OnlineNW
OnSmart Technologies
Opinion Research Corporation
Pacific Technology Alliance
PACE Engineers
Parker Telecommunications
PEAK Internet
Pioneer Consulting
Pivot Group, LLC
Port of Portland
Portland General Electric
Portland Metro STEM Partnership
Portland Public Schools
Portland State University
Project A
Providence Health & Services
Qwest
SAIC / Leidos

Salem Creative Network
Salem-Keizer Public Schools
SandyNet
Satellite Broadcasting and Communications Association
Schools, Health and Libraries Broadband Coalition (SHLB)
Senator Merkley's Office
Sherman County
SNGroup.com
Sprint
State Educational Technology Directors Association
State of Washington
Strategic Networks Group
Technology Association of Oregon
Telehealth Alliance of Oregon
Tillamook County
TRACER
U.S. Department of Agriculture Rural Development
Verizon
Verizon Wireless
Windwave
Washington Department of Commerce Broadband Office
Washington State University
Wave Broadband
Wave Business
WEBVISIONS
Welcome Home Health, Inc.
Western Independent Networks (WIN)
WiFi Now Networks
Willamette ESD
Wtechlink
Zayo Group

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Acknowledgements

Timothy Downs, SmartGig Media

Craig Honeyman, League of Oregon Cities

Avery Pickard, Oregon Economic Development Association

John Irwin, J Irwin Consulting

Wally Rogers, Office of the State CIO, Enterprise Shared Services Manager Oregon E-Government & Transparency

Lisa St. Helen, 911 Advisory Committee Chair, and 911 Bureau of Emergency Communications Operations Manager

Frank Kuchta, State 911 Program Section Manager

Pat Lustig, National Emergency Number Association Western Region Director, and State 911 Program Project Manager

Bob Cozzie, Director Portland Bureau of Emergency Communications
Patrick Sieng, Association of Oregon Counties

Jeffery Stell, Business Oregon

John Talbot, College of Agricultural Sciences, Oregon State University

Carla Wade, Oregon Department of Education